Nokia Customer Care

Service Manual

RM-56 (Nokia 6270)
Mobile Terminal
Part No: 9243846 (Issue 1)

COMPANY CONFIDENTIAL

NOKIA

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	11/2005	TSa	

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IMPORTANT

This document is intended for use by qualified service personnel only.

Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

Company Policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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- Title of the Document + Issue Number/Date of publication
- Latest Amendment Number (if applicable)
- Page(s) and/or Figure(s) in error

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Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Ni-Cd/NiMh batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

Nokia 6270 Service Manual Structure

1 General Information
2 Parts Lists and Component Layouts
3 Service Software Instructions
4 Service Tools and Service Concepts
5 Disassembly / Reassembly Instructions
6 BB Troubleshooting and Manual Tuning Guide
7 RF Troubleshooting and Manual Tuning Guide
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9 System Module
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1 — General Information

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RM-56 product selection

Nokia RM-56 is the first GSM quadband mobile phone in MP supporting 850/900/1800/1900 MHz bands. RM-56 will support EGPRS packet data connection (EDGE) in all these bands. Supported multislot class for both GPRS and EGPRS is MSC 10. RM-56 is based on G3.1S, RAP GSM engine.

According to GSM standard 05.05 it responds to class 4 (max. 2W) in EGSM 900, class 1 (1W) in GSM 1800 and class 1 in GSM 1900. It also supports Bluetooth 1.2 standard. The handset has a full phase 2 Type Approval and it complies with the GSM Type Approval. RM-56 also has a full CE approval and FCC approval.

Phone has 2 megapixel camera with integrated flash and with digital zoom up to 5x. Imaging is supported in familiar landscape camera mode with dedicated camera key. Display resolution is 320x240 and supports 262, 144 colours.

RM-56 introduces slide form factor with true materials. Aluminium covers and chromed details are used for refining the design and to give a premium feeling for the end-user.

RM-56 has stereo speakers providing 3D sound effects and enhancing the audio experience. RM-56 has also stereo FM radio and music player and supports miniSD card with hotswap possibility

The MMS implementation follows the OMA MMS 1.2, AMR and SMIL.

WAP 2.0 compatible XHTML browser over HTTP/TCP/IP stack communicates with a gateway in network.

The supported UI is S40, i.e. RM-56 software is based on ISA platform.

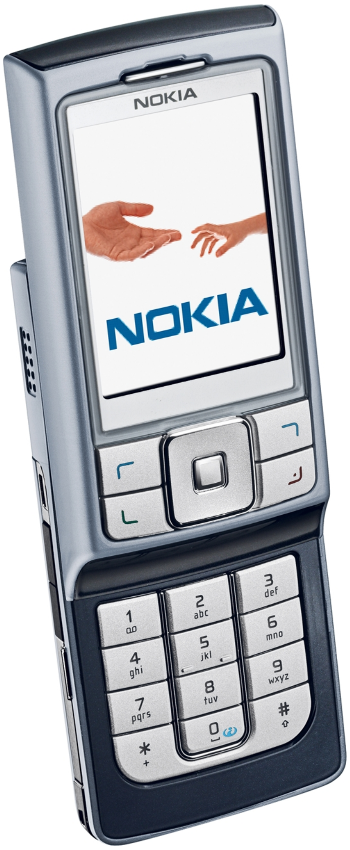

Figure 1 View of RM-56

RM-56 product features and sales package

Imaging

- Integrated Flash LED

- Active TFT colour display, 176 x 208 pixels, 262,144 colours
- High Resolution 320x240 pixels, active area 33.48mm x 44.64mm
- 2MPix camera with integrated camera light
- USB (Pictbridge), BT wireless technology and MMC printing
- Landscape mode for image capturing
- 16 MB flash for user data and SD Mini card (hot swap)

Bearers & transport

- Quadband EGSM 900, GSM 850/1800/1900 supporting EDGE (rel. 99)

Software platform

- SW platform: Nokia Series 40

Connectivity

- Integrated WLAN (IEEE 802.11g)
- USB 2.0 full-speed
- Bluetooth 1.2
- Pop-Port™ connector with ACI
- IrDA (115 kbps)

Productivity

- SMS, MMS and email
- MS Word, PowerPoint , Excel and Adobe PDF viewers
- PIM (Calendar & Contacts)
- Internet browser
- Video streaming (3GPP)
- Push to Talk
- Logs (last calls , timers and history list)
- Audio messaging
- Java™ MIDP 2.0, CLDC 1.13D API, PIM API, File access API
- MP3
- Data Transfer
- Settings Wizard/Access Point Configurator

Sales package

- Transceiver RM-56
- BL-5C Li-ion Battery Cell
- AC Charger
- All-in-one User Guide (warranty card + accessory info + getting started sheet + invitational module for Club Nokia)
- CD-ROM
- Stereo Headset HDS-3
- USB Cable DKU-2

- RS-MMC 64 MB with adapter
- Add-on application guide

Product and module list

Module name	Type code	Notes
System/RF Module	1KZ	Main PWB with components.
UI Module	1MY	Keyboard PWB with components. Part of the UI Frame Assy.
Upper PWB	1LK	Connectors for display, UI PWB and earpiece.
Side key flex	1MG	Volume, POC and camera keys.
Main flex	1LM	Flex between 1KZ and 1MY.

Mobile enhancements

Table 1 Audio

Enhancement	Type
Boom mono headset	HDB-4
Mono headset	HS-5
Classic stereo headset	HS-23
Loopset	LPS-4
Wireless headset	HDW-3
	HS-4W
	HS-11W
Wireless clip-on headset	HS-21W
Wireless stereo headset	HS-12W
Music stand	MD-1

Table 2 Car

Enhancement	Type
Nokia car kit phone	N616
Headrest handsfree	BHF-3
Basic handsfree	HF-3
Advanced car kit (sales pack) (EURO 1)	CK-7W
Car kit	CK-10
Plug-in car handsfree	HF-6W
Mobile holder	CR-44

Table 3 Data

Enhancement	Type
Connectivity cable	CA-53
PC suite	

Table 4 Imaging

Enhancement	Type
Nokia image album	PD-1
Nokia remote camera	PT-6

Table 5 Messaging

Enhancement	Type
Nokia digital pen (Eur/US)	SU-1B
Bluetooth QWERTY keypad (Scandinavian EURO 1)	SU-8W

Table 6 Power

Enhancement	Type
Compact charger	AC-3
Battery Li-on	BL-5C
Travel charger	AC-4
Retractable charger	AC-1
Charger adapter	AC-44
Mobile charger	DC-4

Technical specifications

Transceiver general specifications

Unit	Dimensions (L x W x T)	Weight (g)	Volume (cm^3)
Transceiver with BL-5C battery	104X50X23mm	125	104

Main RF characteristics for GSM850/900/1800/1900 (quadband) and EDGE phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900 and EDGE
Rx frequency band	GSM850: 869 - 890 MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz

Parameter	Unit
Tx frequency band	GSM850: 824 - 849 MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
Output power	GSM850: +5 ... +33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
EDGE output power	EDGE850: +5 ... +29dBm/3.2mW ... 2W
	EDGE900: +5 ... +29dBm/3.2mW ... 2W
	EDGE1800: +0 ... +26dBm/1.0mW ... 1W
	EDGE1900:+0 ... +26dBm/1.0mW ... 1W
Number of RF channels	GSM850: 124
	GSM900: 194
	GSM1800: 374
	GSM1900: 299
Channel spacing	200 kHz
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
Number of EDGE Tx power levels	GSM850 EDGE: 12
	GSM850 EDGE: 12
	GSM850 EDGE: 14
	GSM850 EDGE: 14

Battery endurance

Battery	Capacity (mAh)	Talk time	Stand-by
BL-5C	970mAh	up to 3-5 hrs	up to 200 hours

Charging times

AC-4
Up to

Environmental conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-15ºC...+55ºC	Specifications fulfilled
Reduced performance	-25ºC...-15ºC +55ºC...+70ºC	Operational for shorts periods only
Intermittent operation	-40ºC...-15ºC +70ºC...+85 ºC	Operation not guaranteed but an attempt to operate does not damage the phone.
No operation or storage	<-40ºC...>+85ºC	No storage or operation: an attempt may damage the phone.
Charging allowed	-25ºC...+50ºC	
Long term storage conditions	0ºC...+85ºC	

2 — Parts Lists and Component Layouts

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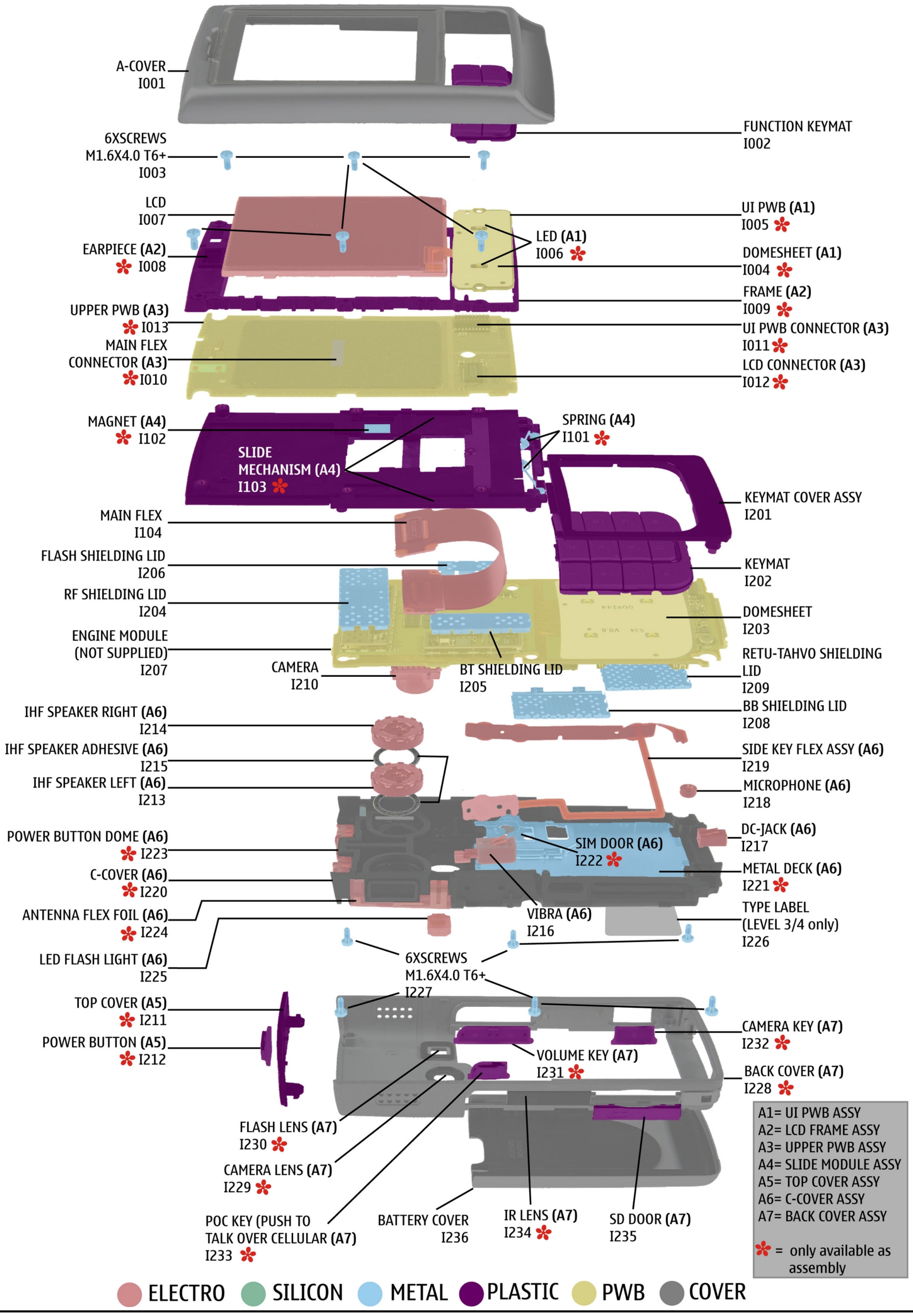
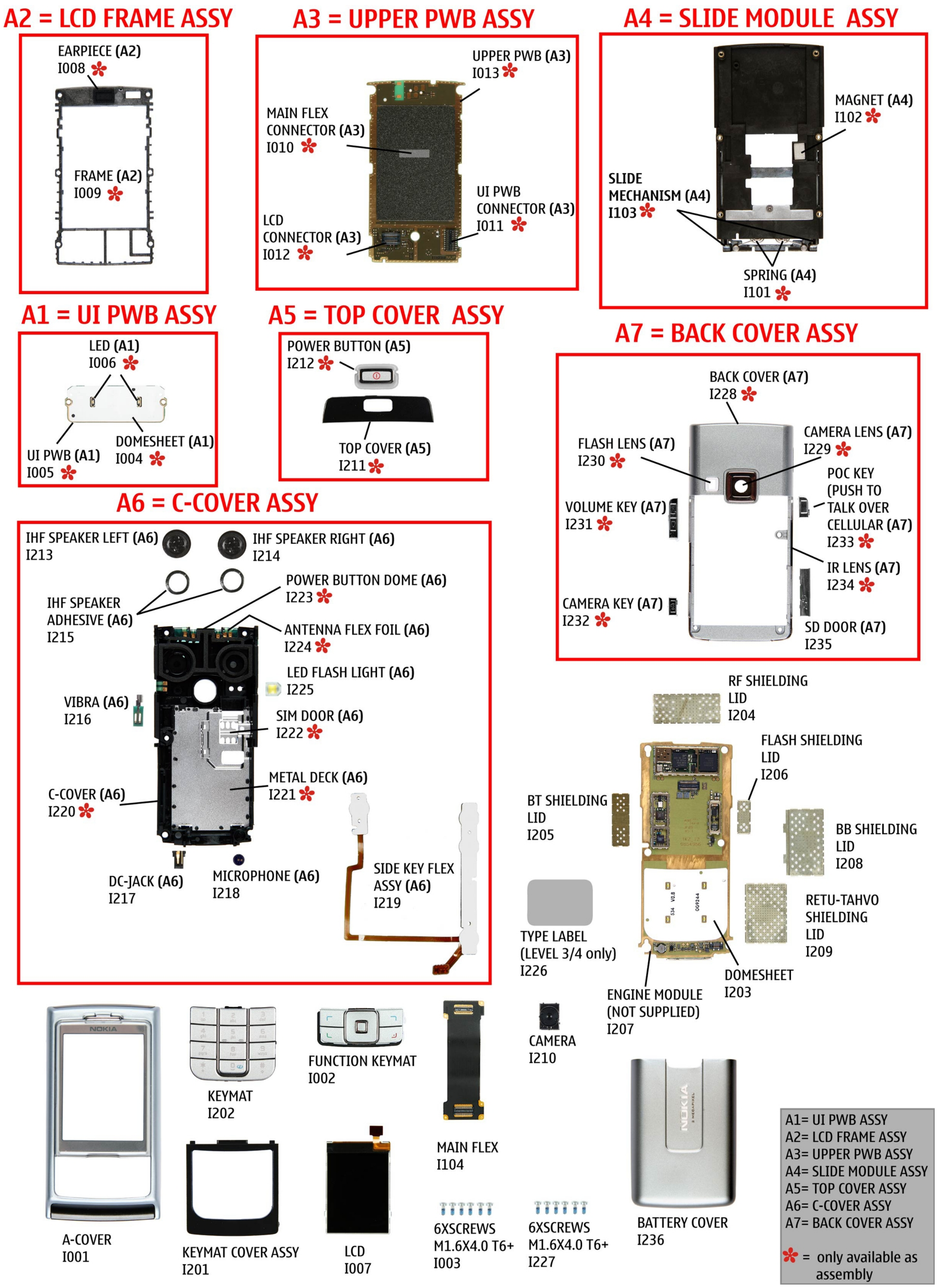
Exploded view

Exploded view


A-COVER I001
FUNCTION KEYMAT I002
6XSCREWS M1.6X4.0 T6+ I003
LCD I007
UI PWB (A1) I005 ✻
LED (A1) I006 ✻
EARPIECE (A2) ✻ I008
DOMESHEET (A1) I004 ✻
FRAME (A2) I009 ✻
UPPER PWB (A3) ✻ I013
UI PWB CONNECTOR (A3) I011 ✻
MAIN FLEX CONNECTOR (A3) ✻ I010
LCD CONNECTOR (A3) I012 ✻
MAGNET (A4) ✻ I102
SPRING (A4) I101 ✻
SLIDE MECHANISM (A4) I103 ✻
KEYMAT COVER ASSY I201
MAIN FLEX I104
FLASH SHIELDING LID I206
KEYMAT I202
RF SHIELDING LID I204
DOMESHEET I203
ENGINE MODULE (NOT SUPPLIED) I207
CAMERA I210
BT SHIELDING LID I205
RETU-TAHVO SHIELDING LID I209
BB SHIELDING LID I208
IHF SPEAKER RIGHT (A6) I214
SIDE KEY FLEX ASSY (A6) I219
IHF SPEAKER ADHESIVE (A6) I215
IHF SPEAKER LEFT (A6) I213
MICROPHONE (A6) I218
POWER BUTTON DOME (A6) ✻ I223
DC-JACK (A6) I217
SIM DOOR (A6) I222 ✻
C-COVER (A6) ✻ I220
METAL DECK (A6) I221 ✻
ANTENNA FLEX FOIL (A6) ✻ I224
VIBRA (A6) I216
TYPE LABEL (LEVEL 3/4 only) I226
LED FLASH LIGHT (A6) I225
6XSCREWS M1.6X4.0 T6+ I227
TOP COVER (A5) ✻ I211
CAMERA KEY (A7) I232 ✻
POWER BUTTON (A5) ✻ I212
VOLUME KEY (A7) I231 ✻
BACK COVER (A7) I228 ✻
FLASH LENS (A7) I230 ✻
CAMERA LENS (A7) I229 ✻
POC KEY (PUSH TO TALK OVER CELLULAR (A7) I233 ✻
BATTERY COVER I236
IR LENS (A7) I234 ✻
SD DOOR (A7) I235
A1= UI PWB ASSY
A2= LCD FRAME ASSY
A3= UPPER PWB ASSY
A4= SLIDE MODULE ASSY
A5= TOP COVER ASSY
A6= C-COVER ASSY
A7= BACK COVER ASSY
✻ = only available as assembly
● ELECTRO ● SILICON ● METAL ● PLASTIC ● PWB ● COVER

Mechanical spare parts overview


A2 = LCD FRAME ASSY
EARPIECE (A2) I008 ✱
FRAME (A2) I009 ✱
A3 = UPPER PWB ASSY
UPPER PWB (A3) I013 ✱
MAIN FLEX CONNECTOR (A3) I010 ✱
UI PWB CONNECTOR (A3) I011 ✱
LCD CONNECTOR (A3) I012 ✱
A4 = SLIDE MODULE ASSY
MAGNET (A4) I102 ✱
SLIDE MECHANISM (A4) I103 ✱
SPRING (A4) I101 ✱
A1 = UI PWB ASSY
LED (A1) I006 ✱
DOMESHEET (A1) I004 ✱
UI PWB (A1) I005 ✱
A5 = TOP COVER ASSY
POWER BUTTON (A5) I212 ✱
TOP COVER (A5) I211 ✱
A7 = BACK COVER ASSY
BACK COVER (A7) I228 ✱
FLASH LENS (A7) I230 ✱
CAMERA LENS (A7) I229 ✱
POC KEY (PUSH TO TALK OVER CELLULAR (A7) I233 ✱
VOLUME KEY (A7) I231 ✱
IR LENS (A7) I234 ✱
CAMERA KEY (A7) I232 ✱
SD DOOR (A7) I235
A6 = C-COVER ASSY
IHF SPEAKER LEFT (A6) I213
IHF SPEAKER RIGHT (A6) I214
POWER BUTTON DOME (A6) I223 ✱
IHF SPEAKER ADHESIVE (A6) I215
ANTENNA FLEX FOIL (A6) I224 ✱
LED FLASH LIGHT (A6) I225
VIBRA (A6) I216
SIM DOOR (A6) I222 ✱
METAL DECK (A6) I221 ✱
C-COVER (A6) I220 ✱
DC-JACK (A6) I217
MICROPHONE (A6) I218
SIDE KEY FLEX ASSY (A6) I219
RF SHIELDING LID I204
FLASH SHIELDING LID I206
BT SHIELDING LID I205
BB SHIELDING LID I208
RETU-TAHVO SHIELDING LID I209
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MAIN FLEX I104
KEYMAT COVER ASSY I201
LCD I007
6XSCREWS M1.6X4.0 T6+ I003
6XSCREWS M1.6X4.0 T6+ I227
BATTERY COVER I236

A1= UI PWB ASSY
A2= LCD FRAME ASSY
A3= UPPER PWB ASSY
A4= SLIDE MODULE ASSY
A5= TOP COVER ASSY
A6= C-COVER ASSY
A7= BACK COVER ASSY

✱ = only available as assembly

Parts lists

Mechanical spare parts list

Note: For Nokia product codes, please refer to the latest Service Bulletins on the Partner Website (PWS). To ensure you are always using the latest codes, please check the PWS on a daily basis.

ITEM/CIRCUIT REF.	PART NAME
I001	A-COVER ASSY
I002	FUNCTION KEYMAT ASSY
I005	UI PWB ASSY
I009	LCD FRAME ASSY
I013	UPPER PWB ASSEMBLY
I104	MAIN FLEX ASSY
I103	SLIDE MODULE ASSEMBLY
I202	ALPHANUMERIC KEYMAT
I201	KEYMAT COVER ASSY
I220	C-COVER ASSEMBLY
I218	EMC MICROPHONE MOD -42DB
I216	VIBRA 1.3V 80MA
I217	CONN 2mm DC-JACK 2.0mm COMPRESS
I219	SIDEKEY FLEX ASSEMBLY
	IHF SPEAKER SPRING PSS 13MM 8R
	IHF-SPEAKER GASKET
I225	LED FLASH CL-660S-4WJ-SD-T
I211	TOP COVER ASSY
I228	BACK COVER ASSEMBLY
I235	SD DOOR
I236	BATTERY DOOR ASSEMBLY
I226	Type Label
I227	M1.6x4.0 TORX PLUS SPEDLACK 2
I007	LCD AM 240X320 262KCO
I210	CAMERA MODULE CCP 2MP 1600x1200
I203	ALPHANUMERIC DOMESHEET

RM-56 component parts list

Component parts list (1 KZ-16a)

Note: For Nokia product codes, please refer to the latest Service Bulletins on the Partner Website (PWS).

To ensure you are always using the latest codes, please check the PWS on a daily basis.

Item	Side	Grid		Description and value			
A1470	Top	H	8	SHIELD_040_013073	FLASH-SHIELD ASSEMBLY	~	~
A2000	Bottom	K	4	SHIELD_040_009978	BB-SHIELD ASSEMBLY	~	~
A2400	Bottom	P	7	SHIELD_040_013091	RETU-TAHVO-SHIELD ASSEMBLY	~	~
A3200	Bottom	M	6	SHIELD_040_019336	ASIP-SHIELD	~	~
A6000	Top	H	3	SHIELD_040_019731	BTH+FM SHIELD ASSEMBLY	~	~
A7000	Top	B	5	SHIELD_040_013089	RF SHIELD ASSEMBLY	~	~
B2100	Bottom	T	8	MIC_OBE_415S42_RC3310CL	CLAPTON EMC MICROPHONE MOD -42DB	~	~
B2101	Bottom	D	2	SPEAKER_SPRING_WD00	SPEAKER+SPRING 105 +-3DB 32R D13.2	~	~
B2102	Bottom	D	8	SPEAKER_SPRING_WD00	SPEAKER+SPRING 105 +-3DB 32R D13.2	~	~
B2200	Bottom	N	7	CRYSTAL_3.3X1.6_H0.9	CRYSTAL 32.768KHZ +-30PPM 12.5PF	32.768kHz	~
C2000	Bottom	S	4	0402C	Chipcap 5% NP0	27p	50V
C2001	Bottom	T	4	0603C	CHIPCAP X5R 470N K 25V 0603	470n	25V
C2002	Top	T	4	0603C	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3
C2003	Top	T	4	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C2004	Top	T	4	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C2005	Top	T	4	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2006	Top	T	4	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2007	Top	T	7	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2008	Top	T	6	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2009	Top	T	6	0402C	Chipcap X7R 10% 16V 0402	10n	16V

Item	Side	Grid		Description and value			
C2010	Top	T	7	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2011	Top	T	5	0402C	Chipcap 5% NP0	10p	50V
C2012	Top	T	5	0402C	Chipcap 5% NP0	10p	50V
C2013	Top	T	5	0402C	Chipcap 5% NP0	10p	50V
C2014	Top	T	5	0402C	Chipcap 5% NP0	10p	50V
C2020	Bottom	S	6	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C2021	Bottom	S	6	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C2030	Bottom	S	5	0402C	CHIPCAP NP0 270P J 25V 0402	270p	25V
C2071	Bottom	I	8	0402C	Chipcap 5% NP0	27p	50V
C2072	Top	T	2	0402C	Chipcap 5% NP0	27p	50V
C2073	Bottom	F	7	TANT_C_6.2X3.4_H1.7	CHIPTCAP 150U M 10V 6X3.2X1.5	150u_10V	10V
C2100	Top	T	7	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C2101	Top	T	7	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C2102	Top	S	7	0603C	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3
C2106	Bottom	G	3	0402C	Chipcap 5% NP0	22p	50V
C2107	Bottom	G	3	0402C	Chipcap 5% NP0	22p	50V
C2111	Bottom	G	2	0402C	Chipcap 5% NP0	22p	50V
C2112	Bottom	G	2	0402C	Chipcap 5% NP0	22p	50V
C2117	Bottom	H	3	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C2118	Bottom	H	3	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C2119	Bottom	H	2	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C2120	Bottom	H	3	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C2124	Bottom	G	3	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C2126	Bottom	F	3	0805C	CHIPCAP X5R 10U M 6V3 0805	10U	6V3

Item	Side	Grid		Description and value			
C2127	Bottom	G	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2200	Bottom	O	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2201	Bottom	O	8	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2202	Bottom	N	9	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2203	Bottom	N	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2204	Bottom	N	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2205	Bottom	N	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2206	Bottom	N	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2207	Bottom	N	8	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2208	Bottom	N	7	0402C	Chipcap 5% NP0	27p	50V
C2209	Bottom	N	7	0402C	Chipcap 5% NP0	22p	50V
C2210	Bottom	P	8	0603C	CHIPCAP X5R 1U K 16V 0603	1u0	16V
C2211	Bottom	Q	8	0805C	CHIPCAP X5R 4U7 K 10V 0805	4u7	10V
C2212	Bottom	Q	7	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2213	Bottom	O	8	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2214	Bottom	O	8	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2215	Bottom	P	8	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2216	Bottom	P	8	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2217	Bottom	N	8	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2218	Bottom	Q	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2219	Bottom	N	8	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V

Item	Side	Grid		Description and value			
C2220	Bottom	P	7	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2221	Bottom	P	9	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2222	Bottom	P	8	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2223	Bottom	P	6	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2224	Bottom	O	6	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2225	Bottom	O	8	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2226	Bottom	P	8	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2227	Bottom	P	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2228	Bottom	P	8	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2229	Bottom	Q	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2230	Bottom	O	8	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2231	Bottom	P	6	0805C	CHIPCAP X5R 10U M 6V3 0805	10U	6V3
C2232	Bottom	P	8	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2270	Bottom	P	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2271	Bottom	P	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2272	Bottom	O	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2273	Bottom	Q	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2274	Bottom	Q	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2275	Bottom	Q	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2281	Bottom	P	9	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V

Item	Side	Grid		Description and value			
C2300	Bottom	R	6	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2301	Bottom	R	6	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2302	Bottom	Q	6	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2303	Bottom	S	8	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2304	Bottom	Q	7	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2305	Bottom	S	9	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2306	Bottom	S	8	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2307	Bottom	S	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2309	Bottom	R	6	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2312	Bottom	S	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2313	Bottom	S	8	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2314	Bottom	Q	8	0805C	CHIPCAP X5R 4U7 M 25V 0805	4u7	25V
C2315	Bottom	Q	9	0805C	CHIPCAP X5R 4U7 M 25V 0805	4u7	25V
C2316	Bottom	R	9	0402C	Chipcap 5% NP0	56p	50V
C2317	Bottom	R	9	0402C	Chipcap 5% NP0	27p	50V
C2400	Bottom	M	8	0402C	Chipcap 5% NP0	22p	50V
C2401	Bottom	M	8	0402C	Chipcap 5% NP0	22p	50V
C2402	Top	I	7	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2403	Top	F	6	0402C	Chipcap 5% X7R	1n0	50V
C2404	Top	F	5	0402C	Chipcap 5% X7R	1n0	50V
C2405	Top	J	7	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2406	Top	F	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2407	Top	E	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V

Item	Side	Grid		Description and value			
C2408	Bottom	P	9	0402C	Chipcap 5% NP0	27p	50V
C2410	Top	D	6	0402C	Chipcap 5% NP0	27p	50V
C2600	Bottom	M	2	0805C	CHIPCAP X5R 4U7 K 6V3 0805	4u7	6V3
C2601	Bottom	L	2	0402C	Chipcap 5% NP0	22p	50V
C2602	Bottom	L	2	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C2603	Bottom	L	2	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C2700	Bottom	I	8	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C2800	Bottom	L	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2801	Bottom	M	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2802	Bottom	L	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2803	Bottom	K	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2804	Bottom	M	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2805	Bottom	J	2	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2807	Bottom	M	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2808	Bottom	M	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2809	Bottom	M	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2810	Bottom	K	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2811	Bottom	K	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2812	Bottom	L	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2813	Bottom	M	2	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2814	Bottom	M	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2815	Bottom	K	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V

Item	Side	Grid		Description and value			
C2816	Bottom	K	5	0402C	Chipcap 5% NP0	27p	50V
C2818	Bottom	K	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2819	Bottom	K	4	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2820	Bottom	M	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2821	Bottom	M	3	0402C	Chipcap 5% NP0	27p	50V
C2822	Bottom	K	4	0402C	Chipcap 5% NP0	27p	50V
C2830	Bottom	M	4	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C3000	Bottom	I	2	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3001	Bottom	I	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C3002	Bottom	I	2	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3003	Bottom	J	5	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C3004	Bottom	J	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3005	Bottom	I	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3006	Bottom	I	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3007	Bottom	I	5	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C3008	Bottom	J	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3009	Bottom	I	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3010	Bottom	M	2	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3011	Bottom	K	4	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3012	Bottom	K	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3013	Bottom	K	4	0402C	Chipcap 5% NP0	27p	50V
C3100	Bottom	M	7	0402C	Chipcap 5% NP0	27p	50V

Item	Side	Grid		Description and value			
C3200	Bottom	N	5	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C3201	Bottom	L	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C3202	Bottom	L	6	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C3203	Bottom	M	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C3204	Bottom	M	6	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C3301	Bottom	E	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C3302	Bottom	H	4	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C3303	Bottom	G	4	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C3320	Top	F	8	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3321	Top	F	8	0805C	CHIPCAP X5R 4U7 K 6V3 0805	4u7	6V3
C3322	Top	F	8	1206C_H1.8	CHIPCAP 2U2 K 25V 1206	2u2	25V
C3323	Bottom	G	8	0402C	Chipcap 5% NP0	10p	50V
C3324	Top	G	8	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3325	Bottom	G	8	0402C	Chipcap 5% NP0	10p	50V
C3326	Bottom	G	7	1206C_H1.8	CHIPCAP 2U2 K 25V 1206	2u2	25V
C6030	Top	G	3	0402C	CHIPCAP NP0 1P2 B 50V 0402	1p2	50V
C6031	Top	F	2	0402C	CHIPCAP N150 18P J 50V 0402	18p	50V
C6032	Top	H	3	0402C	Chipcap 5% NP0	100p	50V
C6033	Top	H	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6034	Top	G	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6035	Top	H	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6036	Top	H	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V

Item	Side	Grid		Description and value			
C6037	Top	H	3	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C6038	Top	G	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6039	Top	G	3	0402C	CHIPCAP N150 18P J 50V 0402	18p	50V
C6040	Top	H	2	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C6055	Top	G	3	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C6157	Top	I	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6158	Top	I	3	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C6159	Top	J	3	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C6162	Top	I	2	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C6163	Top	I	2	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C6164	Top	J	3	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C6165	Top	J	3	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C6170	Top	I	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6176	Top	J	2	0402C	Chipcap 5% NP0	100p	50V
C6178	Top	J	2	0402C	Chipcap 5% NP0	27p	50V
C6179	Top	J	2	0402C	Chipcap 5% NP0	47p	50V
C6188	Top	J	2	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C6189	Top	J	3	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C6190	Bottom	N	6	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C6191	Bottom	N	6	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C7501	Top	A	4	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7502	Top	A	7	0402C	Chipcap +-0.25pF NP0	1p5	50V

Item	Side	Grid		Description and value			
C7503	Top	C	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7504	Top	A	4	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7505	Top	C	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7506	Top	C	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7507	Top	C	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C7508	Top	C	3	0402C	Chipcap 5% NP0	18p	50V
C7509	Top	C	3	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7510	Top	C	7	0402R	Resistor 5% 63mW	15R	~
C7511	Top	B	3	0603C	CHIPCAP NP0 2N2 G 16V 0603	2n2	16V
C7513	Top	C	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C7515	Top	A	3	0402C	Chipcap +-0.25pF NP0	4p7	50V
C7516	Top	B	3	0402C	Chipcap 5% X7R	470p	50V
C7518	Top	C	4	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C7520	Top	B	7	0402C	Chipcap +-0.25pF NP0	3p9	50V
C7522	Top	C	7	0402C	Chipcap +-0.25pF NP0	1p8	50V
C7523	Top	A	7	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C7524	Top	C	6	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C7525	Top	C	8	0402C	Chipcap 5% NP0	18p	50V
C7590	Top	F	2	0402C	Chipcap X7R 5% 16V 0402	10n	16V
C7591	Top	F	3	0402C	Chipcap 5% NP0	100p	50V
C7602	Bottom	A	2	0402C	Chipcap 5% NP0	100p	50V
C7603	Bottom	B	2	0402C	Chipcap 5% NP0	10p	50V
C7604	Bottom	A	3	0402C	Chipcap 5% NP0	10p	50V
C7605	Bottom	A	3	0402C	Chipcap +-0.25pF NP0	2p2	50V
C7606	Bottom	A	3	0402C	Chipcap +-0.25pF NP0	8p2	50V
D2200	Bottom	0	7	TFBGA_108	RETU 3.02 TSA1GJWE TFBGA108	~	~

Item	Side	Grid		Description and value			
D2800	Bottom	L	4	uBGA_289	RAPGSM V1.1 PA uBGA289	~	~
D3000	Bottom	I	4	FBGA133_11.1X10.1	COMBO 256M NOR + 128M SDRAM FBGA133	256MNOR +128MSDRAM	~
F2000	Bottom	S	3	0603_FUSE_AVX2MATS	SM FUSE F 2.0A 32V	2A	~
G2200	Top	T	3	BATTER_EECEP	RTC BACUP CAPAC 311 SIZE FOR 2.6V 4UAH	2.6V	~
G7500	Top	B	3	VCO_DCS02733	VCO 3296-3980MHZ 4-BAND MATSUSHITA	3296-3980MHz	~
G7501	Top	C	2	NKG3176B_H1.0	VCTCXO 38.4MHZ 2.5V	38.4MHz	~
L1480	Bottom	G	8	0402L	CHIP COIL 27N J Q27/800M 0402	27nH	~
L2000	Bottom	S	3	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/100MHz	~
L2001	Top	T	4	0405_2_MATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/100MHz	~
L2002	Top	T	5	0405_2_MATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/100MHz	~
L2003	Top	T	6	0405_2_MATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/100MHz	~
L2004	Top	T	6	COIL_LK_1608	CHIP COIL 68NH J Q12/100MHZ 0603	68nH	~
L2100	Top	E	6	0405_2_MATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/100MHz	~
L2101	Bottom	G	3	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/100MHz	~
L2102	Bottom	F	3	COIL_LQW1608	CHIP COIL 56N J Q38/200MHZ 0603	56nH	~
L2103	Bottom	F	3	COIL_LQW1608	CHIP COIL 56N J Q38/200MHZ 0603	56nH	~
L2104	Bottom	G	2	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/100MHz	~
L2107	Bottom	G	2	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/100MHz	~
L2108	Bottom	D	5	COIL_LQW1608	CHIP COIL 56N J Q38/200MHZ 0603	56nH	~
L2109	Bottom	D	5	COIL_LQW1608	CHIP COIL 56N J Q38/200MHZ 0603	56nH	~

Item	Side	Grid		Description and value			
L2110	Bottom	G	3	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2111	Bottom	F	3	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2202	Bottom	O	9	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2203	Bottom	O	9	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2204	Bottom	O	9	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2205	Bottom	O	9	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2206	Bottom	P	8	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2270	Bottom	P	6	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2271	Bottom	P	6	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2272	Bottom	P	7	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2273	Bottom	P	6	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2301	Bottom	S	6	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2302	Bottom	Q	6	CHOKE_SER400_H1.2	INDUCT WW 10UH 0A65 0R35 4X4X1.2	10uH	~
L2304	Bottom	R	8	CHOKE_SER300_H1.5	CHOKE 22U M 0R7 0.35A 3.0x3.0x1.5	22uH	~
L2305	Bottom	S	8	0603_BLM	FERRITE BEAD 0R5 600R/100MHZ 0603	600R/ 100MHz	~
L2306	Bottom	T	7	0603_BLM	FERRITE BEAD 0R5 600R/100MHZ 0603	600R/ 100MHz	~
L2401	Top	E	6	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2402	Top	E	6	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2410	Bottom	B	4	0402L	CHIP COIL 15N J Q30/800M 0402	15nH	~
L2411	Bottom	A	5	0402L	CHIP COIL 15N J Q30/800M 0402	15nH	~

Item	Side	Grid		Description and value			
L3200	Bottom	N	5	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L3301	Bottom	E	6	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L3304	Top	I	8	CHOKE_SER300	CHOKE 3.3UH 0R252 0A82 310 CASE SIZE	3u3H	~
L3305	Top	E	8	0805_BLM21	FERR.BEAD 0R03 42R/ 100MHZ 3A 0805	42R/ 100MHz	~
L6030	Top	G	3	0402L	CHIP COIL 3N3 +-0N3 Q28/800M 0402	3n3H	~
L6031	Top	G	2	0402L	CHIP COIL 3N3 +-0N3 Q28/800M 0402	3n3H	~
L6156	Top	I	2	COIL_0603CS	CHIP COIL 47N G Q38/200MHZ 0603	47nH	~
L6176	Top	J	2	COIL_LQW1608	CHIP COIL 120N J Q32/150MHZ 0603	120nH	~
L7500	Top	B	5	0402L	CHIP COIL 12N J Q31/800M 0402	12nH	~
L7501	Top	B	5	0402L	CHIP COIL 12N J Q31/800M 0402	12nH	~
L7502	Top	C	4	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L7503	Top	C	7	0402_ELJRF	CHIP COIL 27N J Q7/100M 0402	27nH	~
L7504	Top	B	5	0402L	CHIP COIL 22N J Q28/800M 0402	22nH	~
L7505	Top	B	5	0402L	CHIP COIL 22N J Q28/800M 0402	22nH	~
L7506	Top	A	5	0402L	FERR.BEAD 240R7100M 0.4A 0R4 0402	240R/ 100MHz	~
L7507	Top	C	5	0402L	FERR.BEAD 240R7100M 0.4A 0R4 0402	240R/ 100MHz	~
L7515	Top	B	3	0402L	CHIP COIL 15N J Q30/800M 0402	15nH	~
L7601	Bottom	A	3	0402L_H0.45	CHIP COIL 5N6 +-0N1 Q26/1GHZ 0402	5n6H	~
M2100	Bottom	H	1	VIBRA_4CR_1002W A	VIB MOTOR ASSY 1.3VDC 80MA 9000RPM	~	~
N2000	Bottom	S	7	PDSO_G6	TI ANALOG SWITCH TS5A3159DCKR	~	~

Item	Side	Grid		Description and value			
N2001	Bottom	S	6	PDSO_G6	TI ANALOG SWITCH TS5A3159DCKR	~	~
N2101	Bottom	G	3	XBGA_N16	AF AMP TPA2012D2 77DB/217HZ CSP	~	~
N2300	Bottom	R	7	TFBGA_84_6.15X6.15	TAHVO V5.2 LF TFBGA84	~	~
N2301	Bottom	R	9	USMD8_1.69X1.69	WHITE LED DRIVER 4LEDS 500MW 8BUMP USMD8	~	~
N2401	Top	J	7	SH248	T HALL SENSOR 2.75V HED55	~	~
N2600	Bottom	L	1	TFDU5307_TR3	IRDA TFDU5307-TR3 1.15MBIT/S 8.5X2.5X3MM	~	~
N3200	Bottom	L	6	USMD16_2.03X2.03	VREG & LEVEL SHIFT LP3928 USMD16	~	2.8V
N3301	Top	G	8	SON3024_8	STEP-UP DC/DC CONV SON3024-8	~	~
N3302	Bottom	G	4	USMD5_1.442X1.087_H0.675	REG 1.8V/150MA LP2985ITLX USMD5 NOPB	~	1.8V
N6030	Top	G	3	CSP_47_3.85X4.05	BC4-ROM1.0RDL	~	~
N6156	Top	J	3	WFBGA34_2_3.57X3.57	FM RECEIVER TEA5761UK N4B CSP (TI)	~	~
N7505	Top	B	4	TFBGA144	AHNE301A TRANCEIVER RFIC TFBGA144	~	~
N7520	Top	B	7	RF9282E3.6	PA RF9282E6.3 GSM/EDGE 850/900/1800/1900	~	~
N7601	Bottom	A	2	SC70_6_FAIR	RF SW SC70	~	~
R2000	Top	T	4	0402R	Resistor 5% 63mW	220R	~
R2001	Top	T	4	uBGA11_2.15X1.65	ASIP MIC W/ESD RES +CAP+ZDI BGA11	~	~
R2002	Top	T	6	0404_R_SR	Chipres Array 0W06 J 0404	2x22R	~
R2004	Top	T	6	0404_R_SR	Chipres Array 0W06 J 0404	2x22R	~
R2006	Top	T	6	uBGA5	ASIP 4XESD **PB-FREE** BGA5	~	~
R2007	Bottom	S	5	uBGA11_1.6X2.15	ASIP SILIC USB OTG / ESD BGA11	~	~

Item	Side	Grid		Description and value			
R2008	Bottom	S	5	0404_RP	RES NETWORK 0W06 220K/120K J 0404	220k/ 120k	~
R2030	Bottom	S	4	0402R	Resistor 5% 63mW	100R	~
R2070	Top	T	2	0402_NTH5	NTC RES 47K J B=4050 +-3% 0402	47k	~
R2071	Bottom	I	8	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2100	Top	T	7	FLIP_CHIP_8_1.7X1.7	ASIP SINGLE ENDED MICROPHONE INTERF BGA8	~	~
R2101	Top	T	7	0402R	Resistor 5% 63mW	220R	~
R2200	Bottom	N	9	0402R	Resistor 5% 63mW	100k	~
R2201	Bottom	N	8	0402R	Resistor 5% 63mW	120k	~
R2202	Bottom	O	6	0402R	Resistor 5% 63mW	1k0	~
R2203	Bottom	O	6	0402R	Resistor 5% 63mW	1k0	~
R2204	Bottom	O	6	0402R	Resistor 5% 63mW	1k0	~
R2205	Bottom	O	6	0402R	Resistor 5% 63mW	1k0	~
R2206	Bottom	N	6	0402R	Resistor 5% 63mW	1k0	~
R2207	Bottom	N	6	0402R	Resistor 5% 63mW	1k0	~
R2208	Bottom	N	6	0402R	Resistor 5% 63mW	1k0	~
R2209	Bottom	N	6	0402R	Resistor 5% 63mW	1k0	~
R2212	Bottom	O	6	0402R	Resistor 5% 63mW	470R	~
R2213	Bottom	N	8	0402R	Resistor 5% 63mW	4k7	~
R2214	Bottom	N	9	0402R	Resistor 5% 63mW	4k7	~
R2216	Bottom	N	8	0402R	CHIPRES 0W06 2M2 J 0402	2M2	~
R2307	Bottom	R	7	0402R	Resistor 5% 63mW	100R	~
R2400	Bottom	N	8	0402R	Resistor 5% 63mW	10R	~
R2401	Bottom	N	8	0402R	Resistor 5% 63mW	10R	~
R2402	Top	J	7	0402R	Resistor 5% 63mW	100k	~
R2408	Bottom	P	9	0402R	Resistor 5% 63mW	4k7	~
R2410	Bottom	M	7	0402R	Resistor 5% 63mW	180R	~
R2411	Top	D	6	0402R	Resistor 5% 63mW	33R	~
R2600	Bottom	M	2	0805R_THERM1	CHIPRES 0W125 4R7 J 0805	4R7	~
R2700	Bottom	J	6	uBGA8_1.47X1.47	ASIP SIM INTERFACE **LOW CAP**BGA8	~	~

Item	Side	Grid		Description and value			
R2803	Bottom	K	5	0402R	Resistor 5% 63mW	100R	~
R2804	Bottom	K	5	0402R	Resistor 5% 63mW	100R	~
R2830	Bottom	M	4	0402R	Resistor 5% 63mW	10R	~
R3000	Bottom	J	2	0402R	Resistor 5% 63mW	4k7	~
R3002	Bottom	L	5	0402R	Chipres 0W06 jumper 0402	0R	~
R3200	Bottom	M	6	uBGA11_1.62X2.12	ASIP EMIF04-MMC02F2**PB-FREE**	~	~
R3201	Bottom	L	6	0402R	Resistor 5% 63mW	100k	~
R3202	Bottom	L	6	0402R	Resistor 5% 63mW	100k	~
R3203	Bottom	M	6	0402R	Resistor 5% 63mW	100k	~
R3204	Bottom	M	6	0402R	Resistor 5% 63mW	2k2	~
R3303	Top	H	7	0402R	CHIPRES 0W06 6R8 J 0402	6R8	~
R3306	Top	G	7	0402R	Resistor 5% 63mW	100R	~
R3307	Bottom	G	8	0402R	Chipres 0W06 5R6 J 0402	5R6	~
R3312	Bottom	H	6	0402R	Resistor 5% 63mW	1k0	~
R3313	Bottom	I	6	0402R	Resistor 5% 63mW	1k0	~
R3314	Bottom	H	6	0402R	Resistor 5% 63mW	47R	~
R3315	Bottom	H	6	0402R	Resistor 5% 63mW	47R	~
R3317	Bottom	H	6	0402R	Resistor 5% 63mW	47R	~
R6030	Top	H	3	0402R	Resistor 5% 63mW	10k	~
R6031	Top	G	2	0402R	Resistor 5% 63mW	10k	~
R6032	Top	H	2	0402R	CHIPRES 0W06 2R2 J 0402	2R2	~
R6034	Top	G	3	0402R	Resistor 5% 63mW	10k	~
R6050	Top	G	2	0402R	Resistor 5% 63mW	100k	~
R6107	Top	I	2	0402R	Chipres 0W06 jumper 0402	0R	~
R6156	Top	I	3	0402R	Chipres 0W06 jumper 0402	0R	~
R6159	Top	I	2	0402R	Resistor 5% 63mW	10k	~
R6160	Top	I	2	0402R	Resistor 5% 63mW	100k	~
R7501	Top	B	3	0402R	Resistor 5% 63mW	2k2	~
R7502	Top	A	4	0402R	CHIPRES 0W06 10K F 0402	10k	~

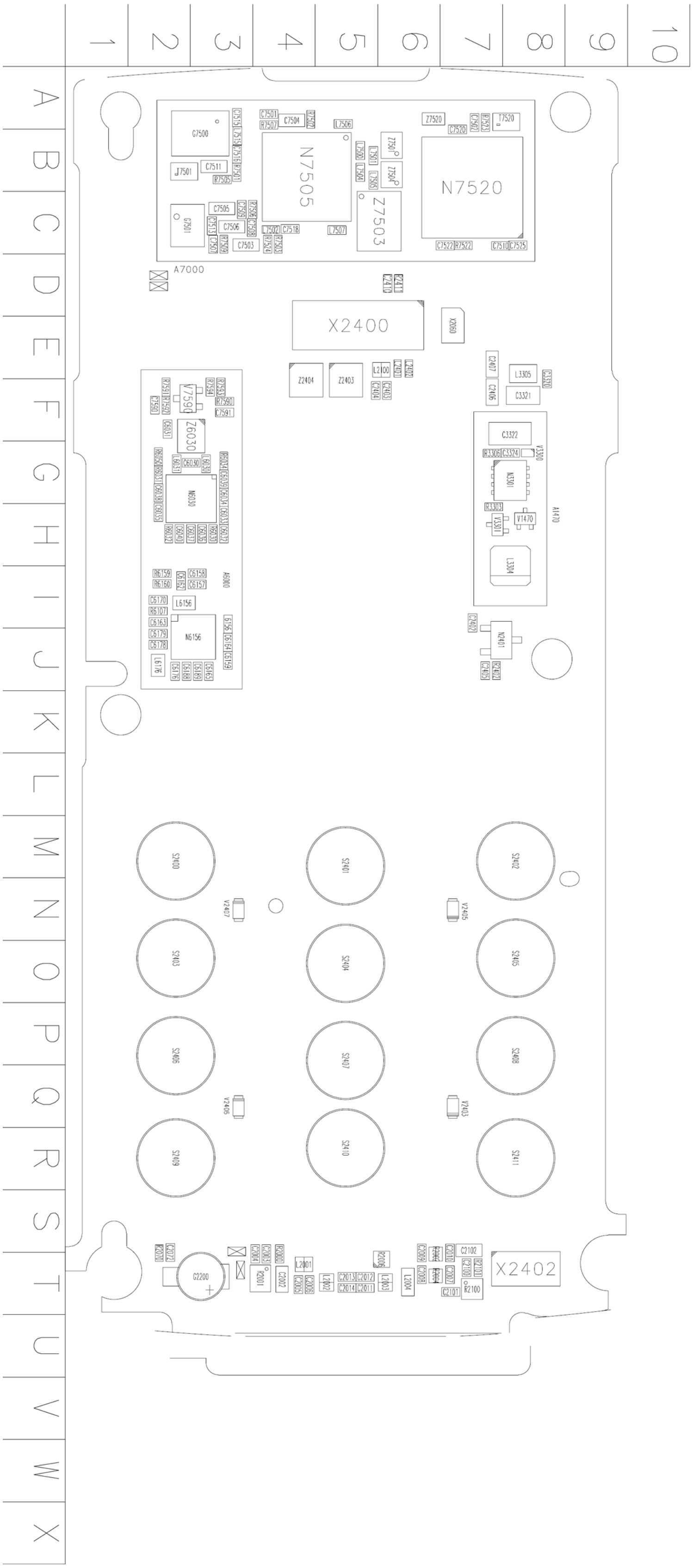
Item	Side	Grid		Description and value			
R7503	Top	C	4	0402R	Resistor 5% 63mW	4k7	~
R7505	Top	B	3	0402R	CHIPRES 0W06 8K2 F 0402	8k2	~
R7506	Top	C	4	0402R	Resistor 5% 63mW	10R	~
R7507	Top	A	4	0402R	Resistor 5% 63mW	10R	~
R7509	Top	C	3	0402R	Resistor 5% 63mW	22k	~
R7522	Top	C	7	0402R	CHIPRES 0W06 27K F 0402	27k	~
R7523	Top	A	7	0402R	Chipres 0W06 jumper 0402	0R	~
R7524	Top	C	4	0402R	Resistor 5% 63mW	10R	~
R7590	Top	F	3	0402R	Resistor 5% 63mW	2k2	~
R7591	Top	F	2	0402R	Resistor 5% 63mW	330R	~
R7592	Top	F	2	0402R	Resistor 5% 63mW	27k	~
R7593	Top	F	3	0402R	Chipres 0W06 jumper 0402	0R	~
R7594	Top	F	3	0402R	Resistor 5% 63mW	1k2	~
R7595	Top	F	3	0402R	Resistor 5% 63mW	1k2	~
R7601	Bottom	B	3	0402R	Chipres 0W06 jumper 0402	0R	~
R7602	Bottom	A	3	0402R	Chipres 0W06 jumper 0402	0R	~
T7501	Top	B	2	TRANS_LDB15	TRANSF BALUN 3800 +-550MHZ 0805	~	~
T7520	Top	A	8	TRANS_LDB15	TRANSF BALUN 1800 +-100mhz 2x1.25	~	~
V1470	Top	H	8	SC_89	DI SCH DUAL 0.4V 1MA SOT490	~	~
V2000	Bottom	S	4	CASE_457	TVS DI 1PMT16AT3 16V 175W PWRMITE	~	~
V2302	Bottom	S	7	SOD323F	SCH DI 30V 2A SOD323F	~	~
V2403	Top	Q	7	LED_LWL28G	LED WHITE 140...280 MCD 10MA TOPFIRE	~	~
V2404	Bottom	N	7	VMT3_R	TR DTC143ZM N RB=4K7 RBE=47K VMT3	~	~
V2405	Top	N	7	LED_LWL28G	LED WHITE 140...280 MCD 10MA TOPFIRE	~	~
V2406	Top	Q	3	LED_LWL28G	LED WHITE 140...280 MCD 10MA TOPFIRE	~	~

Item	Side	Grid		Description and value			
V2407	Top	N	3	LED_LWL28G	LED WHITE 140...280 MCD 10MA TOPFIRE	~	~
V3300	Top	G	8	DIODE_PMEG3002	SCH DI 30V IF 0A2 UFSM 3A IR 10UA SOD882	~	~
V3301	Top	H	7	SC_75A_H0.95	MOSFET N 20V 350MA SOT416	~	~
V7590	Top	F	2	SOT323	Tr NPN 12V 35mA SOT323	~	~
X2000	Bottom	T	5	SYSCON_MQ202_NK_14R3	SM SYSTEM CONNECTOR 14POL	~	~
X2002	Bottom	T	3	CON_JACK_HR33NK_2DJA_2S	CONN DC-JACK 2.0MM 3POL SPR 90DEG	~	~
X2060	Top	E	7	TRACEABILITY_PAD	MODULE ID COMPONENT 2.8X1.8X0.3	~	~
X2070	Bottom	H	7	LYNX_BATT_CONN_H7.5	SM LYNX BATT.CONN 3POL HEIGHT 7.3	~	~
X2400	Top	E	5	CON_DF30FC_40DS_0.4V	SM B2B 2X20 P0.4 F 30V 0.3A DF30FC-40DS-0.4V	~	~
X2402	Top	T	8	MOLEX_500463_0779	5469 CUSTOMIZED CONNECTOR	~	~
X2701	Bottom	J	7	SIM_CONN_470191701	SM SIM CONN 6POL P2.54 H1.7	~	~
X3200	Bottom	Q	3	CONN_DM2B_DSFW_PEJ	MINISD CONN DM2B-DSFW-PEJ-N 125V 0.5A	~	~
X3300	Bottom	F	5	SOCKET_DMD10413	CAMERA MOD.SOCKET 2X7POL SPR P1.4	~	~
X3301	Bottom	F	8	POGO_CNO_3915_3031H	CONN POGO 2 PIN 6.5X5.4X2.3MM	~	~
X6001	Bottom	F	1	C_CLIP_6442631	C-CLIP	~	~
X6002	Bottom	F	1	C_CLIP_6442631	C-CLIP	~	~
X7505	Bottom	B	6	RF_SWITCH_MS_156	SM CONN RF JACK 50R 2W 6GHZ	~	~
X7550	Bottom	A	7	C_CLIP_6442631	C-CLIP	~	~
X7551	Bottom	A	7	C_CLIP_6442631	C-CLIP	~	~
X7553	Bottom	A	6	C_CLIP_6442631	C-CLIP	~	~
X7554	Bottom	A	4	C_CLIP_6442631	C-CLIP	~	~
X7555	Bottom	A	3	C_CLIP_6442631	C-CLIP	~	~
Z2000	Bottom	T	5	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~

Item	Side	Grid		Description and value			
Z2001	Bottom	T	5	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
Z2003	Bottom	S	5	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
Z2400	Bottom	K	6	uBGA25_2.69X2.69	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z2403	Top	F	5	uBGA25_2.69X2.69	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z2404	Top	F	4	uBGA25_2.69X2.69	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z6030	Top	F	3	EZFVQ42NM61S	LTCC FILT 2441.75 +-41.75MHZ 2.5X2	2441.75 MHz	~
Z7501	Top	B	6	FILTER_SXR533	DUAL RX SAW FILTER 1800/1900MHZ 2016	1800/1900MHz	~
Z7503	Top	C	6	MODULE_SP_LMZ_137	TX SAW MODULE GSM 850/900MHZ 4.5X3.2	850/900 MHz	~
Z7504	Top	B	6	FILTER_SXR533	DUAL RX SAW FILTER 850/900MHZ 2016	850/900 MHz	~
Z7520	Top	A	6	FERRITE_FBMJ1608	FERRITE BEAD 0R01 28R/100MHZ 0603	28R/ 100MHz	~

Component layouts

Component layout - top 1KZ-12a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X2400
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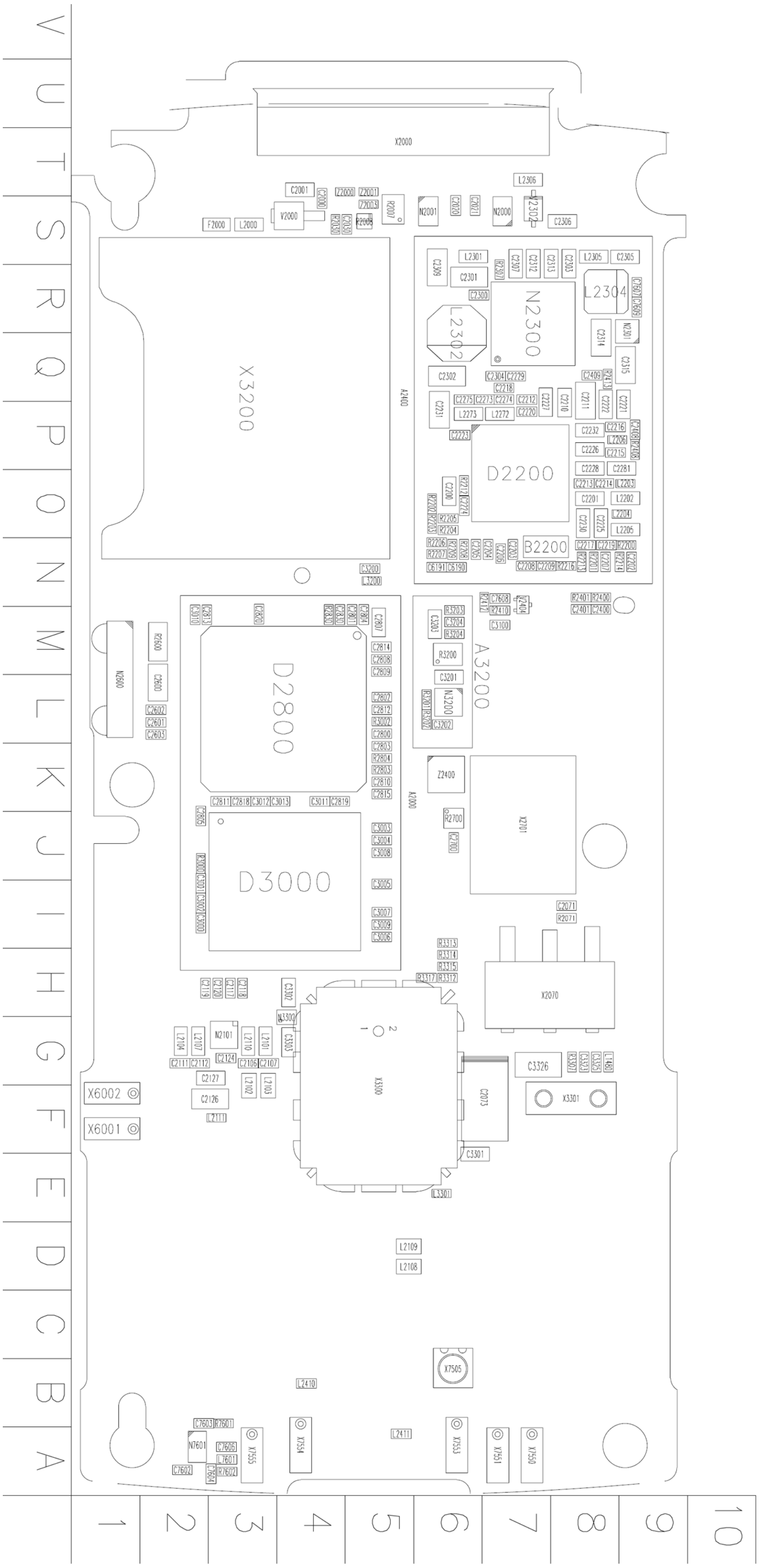
V7590
X2402

Component layout - bottom 1KZ-12a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C3201
C3202
Z2400
R2700
X2701
D3000
N2500
R2500
C2500
C2071
R2071
X2070
X3300
C3326
X3301
C2073
C3301
L3301
N2101
C2127
C2126
L2111
X6002
X6001
L2109
L2108
X7505
L2410
L2411
N7601
X7555
X7554
X7553
X7551
X7550

3 — Service Software Instructions

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Phoenix installation steps in brief

Before you begin

Recommended hardware requirements:

- Computer processor: Pentium 700 MHz or higher
- RAM 256 MB
- Disk space 100-300 MB

Supported operating systems:

- *Windows 2000* Service Pack 3 or higher
- *Windows XP* Service Pack 1 or higher

Context

Phoenix is a service software for reprogramming, testing and tuning phones.

Phoenix installation contains:

- Service software support for all phone models included in the package
- Flash update package files for programming devices
- All needed drivers for:
  - DK2 dongle
  - DKU-2 USB cable

Note: Separate installation packages for flash update files and drivers are also available, but it is not necessary to use them unless there are updates between *Phoenix* service software releases. If separate update packages are used, they should be used after *Phoenix* and data packages have been installed.

The phone model specific data package includes all changing product specific data:

- Product software binary files
- Files for type label printing
- Validation file for the faultlog repair data reporting system
- All product specific configuration files for *Phoenix* software components

Note: *Phoenix* and phone data packages should only be used as complete installation packages. Uninstallation should be made from the *Windows* Control Panel.

To use *Phoenix*, you need to:

Steps

1. Connect a DK2 dongle to the computer parallel port.
2. Install *Phoenix*.
3. Install the phone-specific data package.
4. Configure users.
5. Manage connection settings (depends on the tools you are using).

If you use FPS-8:	• Update FPS-8 software • Activate FPS-8

If you use FPS-10:	• Update FPS-10 software **Note:** There is no need to activate FPS-10. • Activate SX-4 smart card, if you need tuning and testing functions. **Note:** When FPS-10 is used only for product software updates, SX-4 smart card is not needed.

Results

Phoenix is ready to be used with FPS-8 or FPS-10 flash prommers and other service tools.

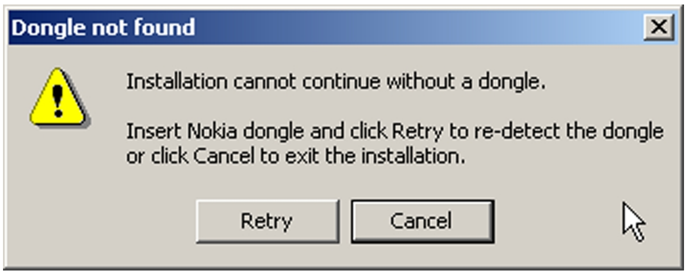
Installing *Phoenix*

Before you begin

- Check that a dongle is attached to the parallel port of your computer.
- Download the *Phoenix* installation package (for example, *phoenix_service_sw_2004_39_x_xx.exe*) to your computer (in *C:|TEMP*, for instance).
- Close all other programs.
- Depending on your operating system, administrator rights may be required to install *Phoenix*.
- If uninstalling or rebooting is needed at any point, you will be prompted by the InstallShield program.

Context

At some point during the installation procedure, you may get the following message:



Dongle not found

Installation cannot continue without a dongle.

Insert Nokia dongle and click Retry to re-detect the dongle or click Cancel to exit the installation.

Figure 2 Dongle not found

This may be a result of a defective or too old PKD-1 dongle.

Check the COM/parallel ports used. After correcting the problem, you can restart the installation.

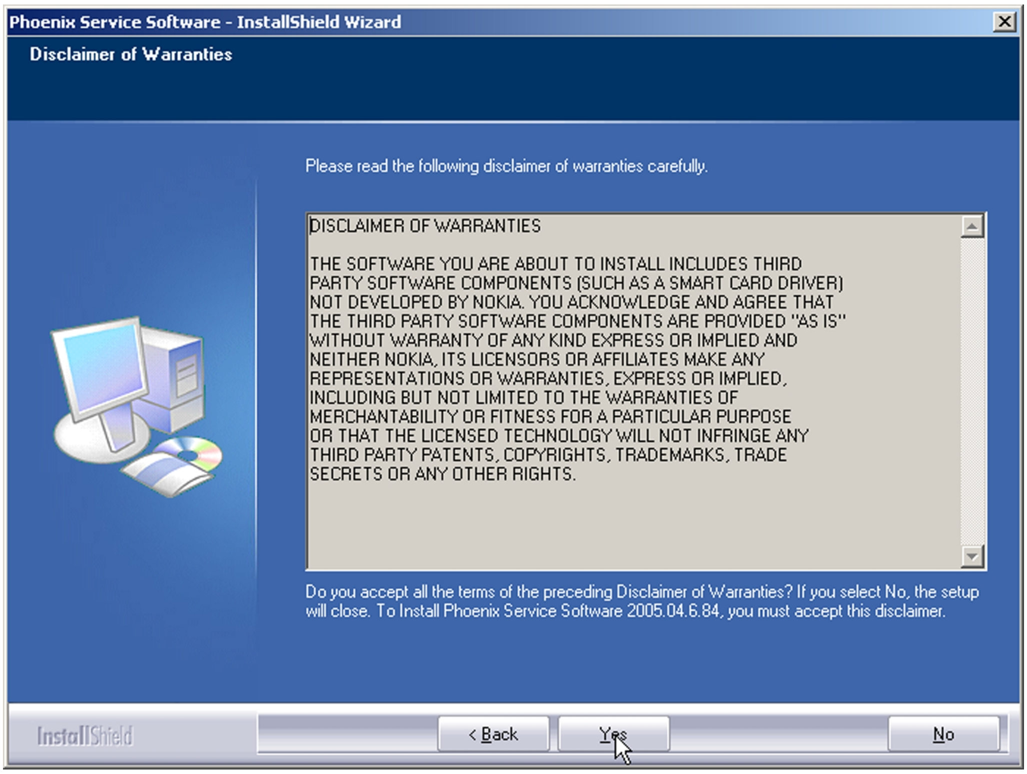
For more detailed information, please refer to *Phoenix* Help files.

Tip: Each feature in *Phoenix* has its own Help function, which can be activated while running the program. Press the **F1** key or the feature's **Help** button to activate a Help file.

Steps

1. To start the installation, run the application file (for example,*phoenix_service_sw_2004_39_x_xx.exe*).
2. In the *Welcome* dialogue, click **Next**.

3. Read the disclaimer text carefully and click **Yes**.



Phoenix Service Software - InstallShield Wizard

Disclaimer of Warranties

Please read the following disclaimer of warranties carefully.

DISCLAIMER OF WARRANTIES

THE SOFTWARE YOU ARE ABOUT TO INSTALL INCLUDES THIRD PARTY SOFTWARE COMPONENTS (SUCH AS A SMART CARD DRIVER) NOT DEVELOPED BY NOKIA. YOU ACKNOWLEDGE AND AGREE THAT THE THIRD PARTY SOFTWARE COMPONENTS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND EXPRESS OR IMPLIED AND NEITHER NOKIA, ITS LICENSORS OR AFFILIATES MAKE ANY REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR THAT THE LICENSED TECHNOLOGY WILL NOT INFRINGE ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADEMARKS, TRADE SECRETS OR ANY OTHER RIGHTS.

Do you accept all the terms of the preceding Disclaimer of Warranties? If you select No, the setup will close. To Install Phoenix Service Software 2005.04.6.84, you must accept this disclaimer.

Figure 3 Disclaimer text

4. Choose the destination folder.

   The default folder *C:|ProgramFiles|Nokia|Phoenix* is recommended.

5. To continue, click **Next.**

   To choose another location, click **Browse** (not recommended).

6. Wait for the components to be copied.

   The progress of the installation is shown in the *Setup Status* window.

7. Wait for the drivers to be installed and updated.

   The process may take several minutes to complete.

   If the operating system does not require rebooting, the PC components are registered right away.

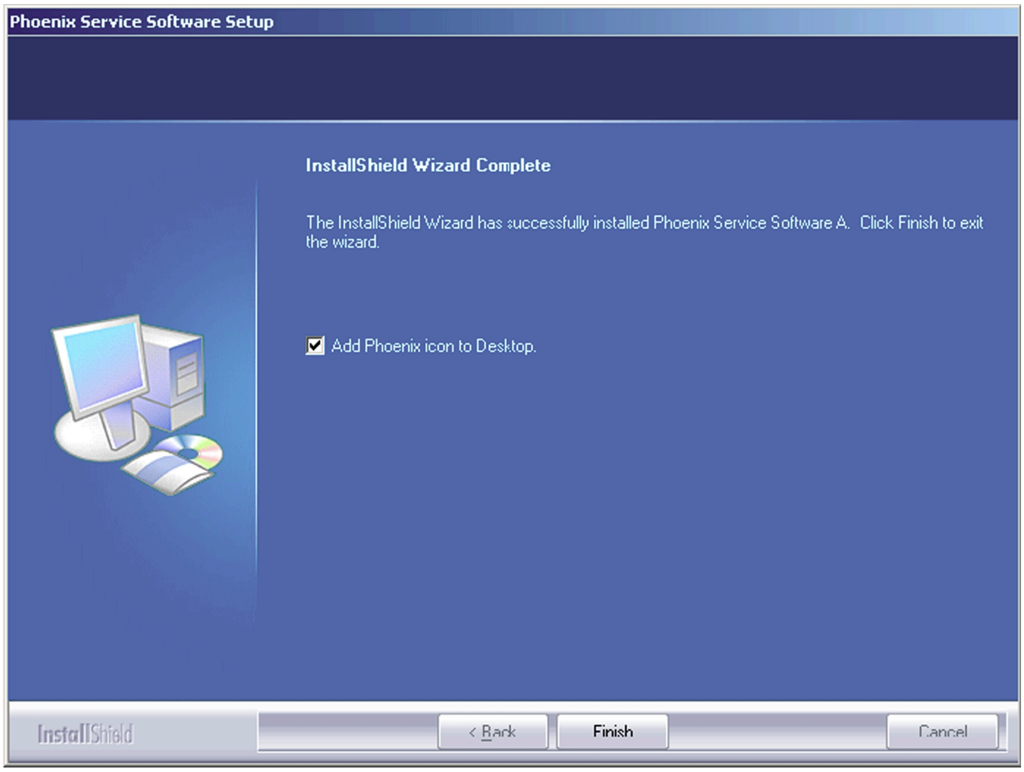
   If the operating system requires restarting your computer, the Install Shield Wizard will notifies about it.

   Select **Yes...** to reboot the PC immediately or **No...** to reboot the PC manually afterwards.

   After the reboot, all components are registered.

   Note: *Phoenix* does not work, if the components have not been registered.

8. To end the installation, click **Finish**.



Phoenix Service Software Setup

InstallShield Wizard Complete

The InstallShield Wizard has successfully installed Phoenix Service Software A. Click Finish to exit the wizard.

☑ Add Phoenix icon to Desktop.

Figure 4 InstallShield Wizard Complete

Next action

After the installation, *Phoenix* can be used after:

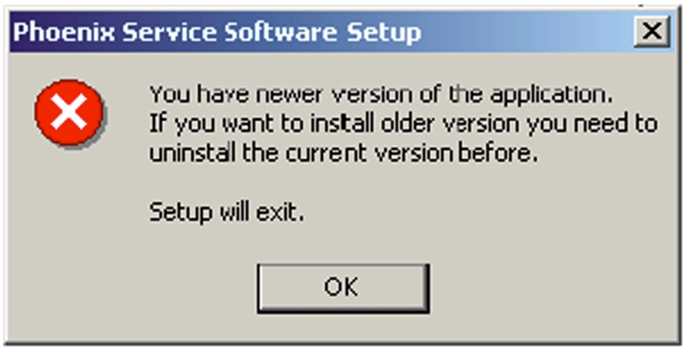
- installing phone model specific data package for *Phoenix*
- configuring users and connections

FPS-8 and FPS-10 flash prommers can be used after updating their flash update package files.

Updating *Phoenix* installation

Context

- If you already have the *Phoenix* service software installed on your computer, you need to update the software when new versions are released.
- To update *Phoenix*, you need to follow the same steps as when installing it for the first time.
- When you are updating, for example, from version **a14_2004_16_4_47** to **a15_2004_24_7_55**, the update will take place automatically without uninstallation.
- Always use the latest available versions of both *Phoenix* and the phone-specific data package. Instructions can be found in the phone model specific Technical Bulletins and phone data package *readme.txt* files (shown during installation).
- If you try to update *Phoenix* with the same version you already have (for example, **a15_2004_24_7_55** to **a15_2004_24_7_55**), you are asked if you want to uninstall the existing version. In this case you can choose between a total uninstallation or a repair installation in a similar way when choosing to uninstall the application from the *Windows* Control Panel.
- If you try to install an older version (for example, downgrade from **a15_2004_24_7_55** to **a14_2004_16_4_47**), installation will be interrupted.



Phoenix Service Software Setup

You have newer version of the application.
If you want to install older version you need to uninstall the current version before.

Setup will exit.

Figure 5 Installation interrupted

- Always follow the instructions on the screen.

Steps

1. Download the installation package to your computer hard disk.
2. Close all other programs.
3. Run the application file (for example, *phoenix_service_sw_2004_39_x_xx.exe*).

Results

A new *Phoenix* version is installed and driver versions are checked and updated.

Uninstalling *Phoenix*

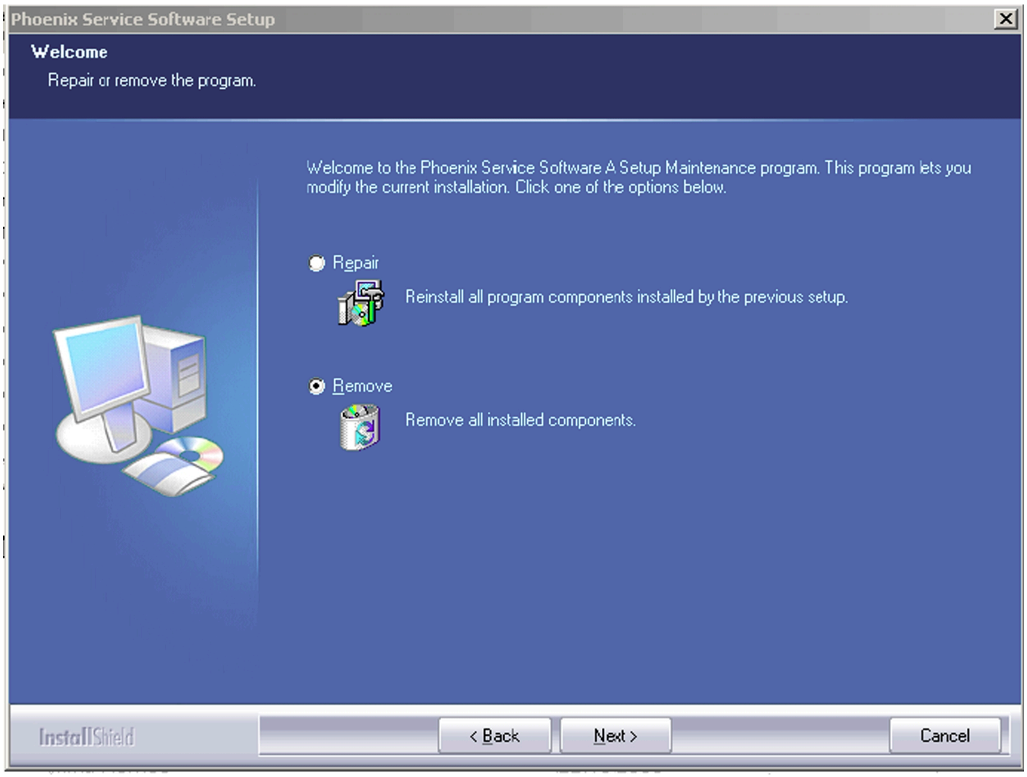
Context

You can uninstall *Phoenix* service software manually from the *Windows* Control Panel.

Steps

1. Open the **Windows Control Panel**, and choose **Add/Remove Programs**.

2. To uninstall *Phoenix*, choose **Phoenix Service Software→Change/Remove→Remove** .



Phoenix Service Software Setup

Welcome

Repair or remove the program.

Welcome to the Phoenix Service Software A Setup Maintenance program. This program lets you modify the current installation. Click one of the options below.

○ Repair

Reinstall all program components installed by the previous setup.

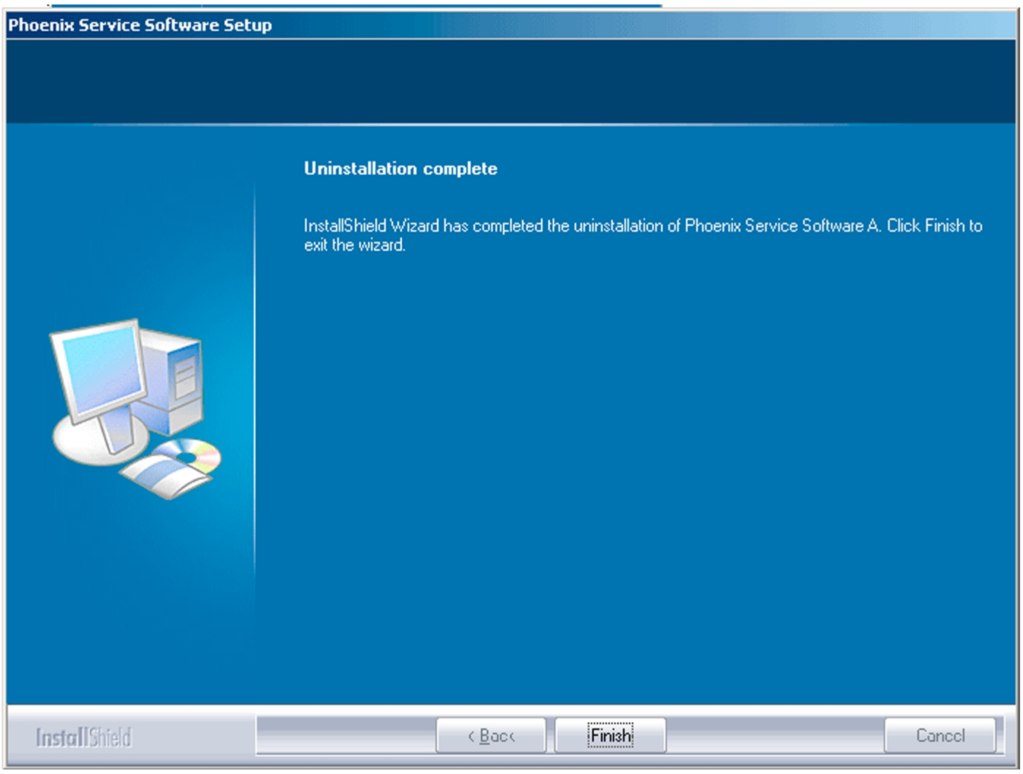
● Remove

Remove all installed components.

Figure 6 Remove program

The progress of the uninstallation is shown.

3. If the operating system does not require rebooting, click **Finish** to complete.



Uninstallation complete

InstallShield Wizard has completed the uninstallation of Phoenix Service Software A. Click Finish to exit the wizard.

Figure 7 Finish uninstallation

If the operating system requires rebooting, InstallShield Wizard will notify you. Select **Yes...** to reboot the PC immediately and **No...** to reboot the PC manually afterwards.

Repairing *Phoenix* installation

Context

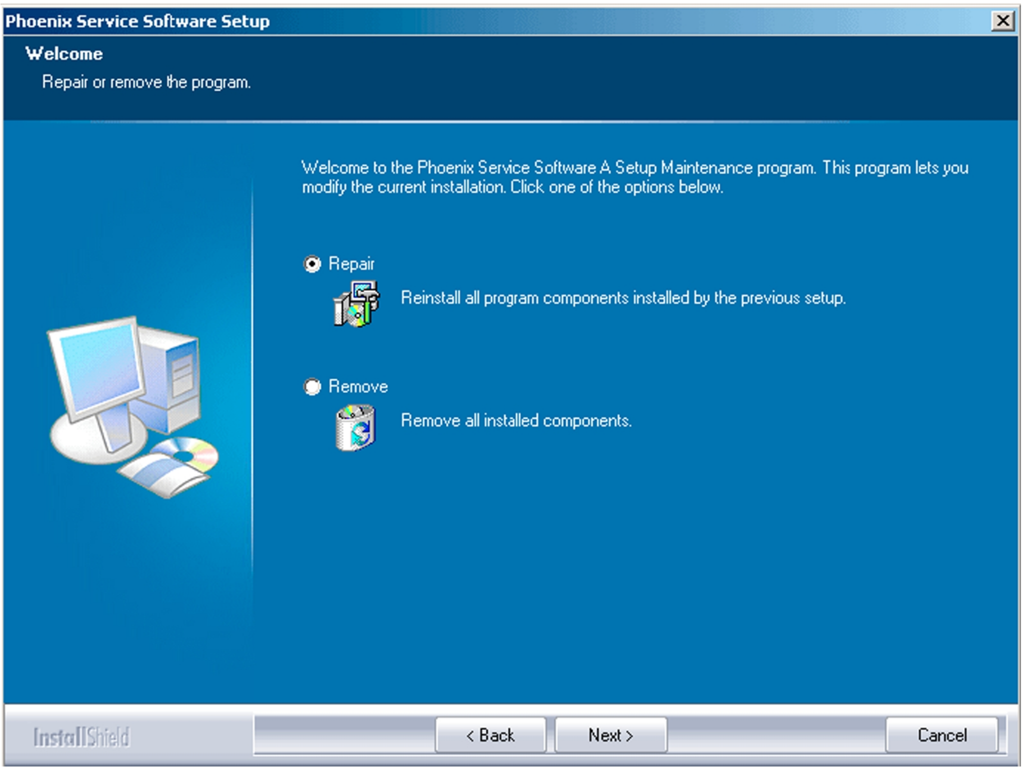
If you experience any problems with the service software or suspect that files have been lost, use the repair function before completely reinstalling *Phoenix*.

Note: The original installation package (for example, *phoenix_service_sw_a15_2004_24_7_55.exe*) must be found on your PC when you run the repair setup.

Steps

1. Open **Windows Control Panel→Add/Remove Programs** .
2. Choose **Phoenix Service Software→Change/Remove** .

3. In the following view, select **Repair**.



Phoenix Service Software Setup

Welcome

Repair or remove the program.

Welcome to the Phoenix Service Software A Setup Maintenance program. This program lets you modify the current installation. Click one of the options below.

● Repair

Reinstall all program components installed by the previous setup.

○ Remove

Remove all installed components.

Figure 8 Repair program

Phoenix reinstalls components and registers them.

The procedure is the same as when updating *Phoenix*.

4. To complete the repair, click **Finish**.

Phone data package overview

Each product has its own data package (DP). The product data package contains all product-specific data files to make the Phoenix service software and tools usable with a certain phone model.

The phone data package contains the following:

- Product software binary files
- Files for type label printing
- Validation file for the fault log repair data reporting system
- All product-specific configuration files for Phoenix software components

Data files are stored in **C:\Program Files\Nokia\Phoenix** (default).

Installing phone data package

Before you begin

- A phone-specific data package contains all data required for the *Phoenix* service software and service tools to be used with a certain phone model.
- Check that a dongle is attached to the parallel port of your computer.
- Install *Phoenix* service software.

- Download the installation package (for example, *XX-XX_dp_EA_v_1_0.exe*) to your computer (for example, in C:\TEMP).
- Close all other programs.

(XX-XX = type designator of the product)

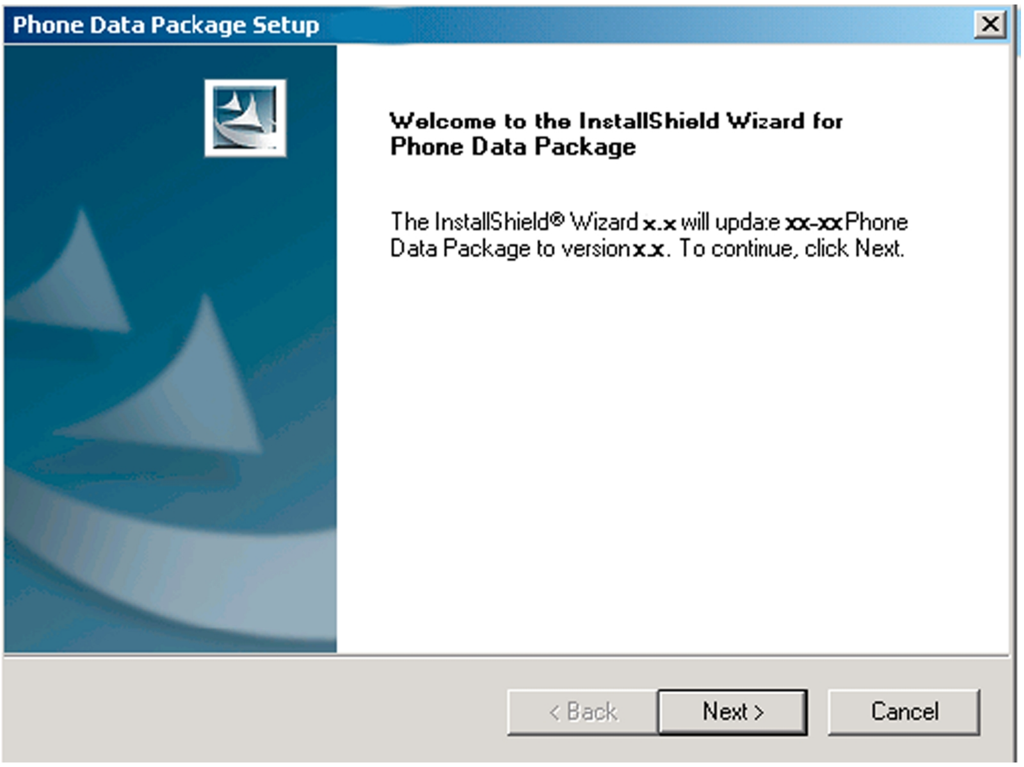
If you already have *Phoenix* installed on your computer, you will need to update it when a new version is released.

> **Note:** Often *Phoenix* and the phone-specific data package come in pairs, meaning that a certain version of *Phoenix* can only be used with a certain version of a data package. Always use the latest available versions of both. Instructions can be found in phone-specific Technical Bulletins and *readme.txt* files of data packages.

Steps

1. To start the installation, run the application file (for example, *XX-XX_dp_EA_ v_1_0.exe*),

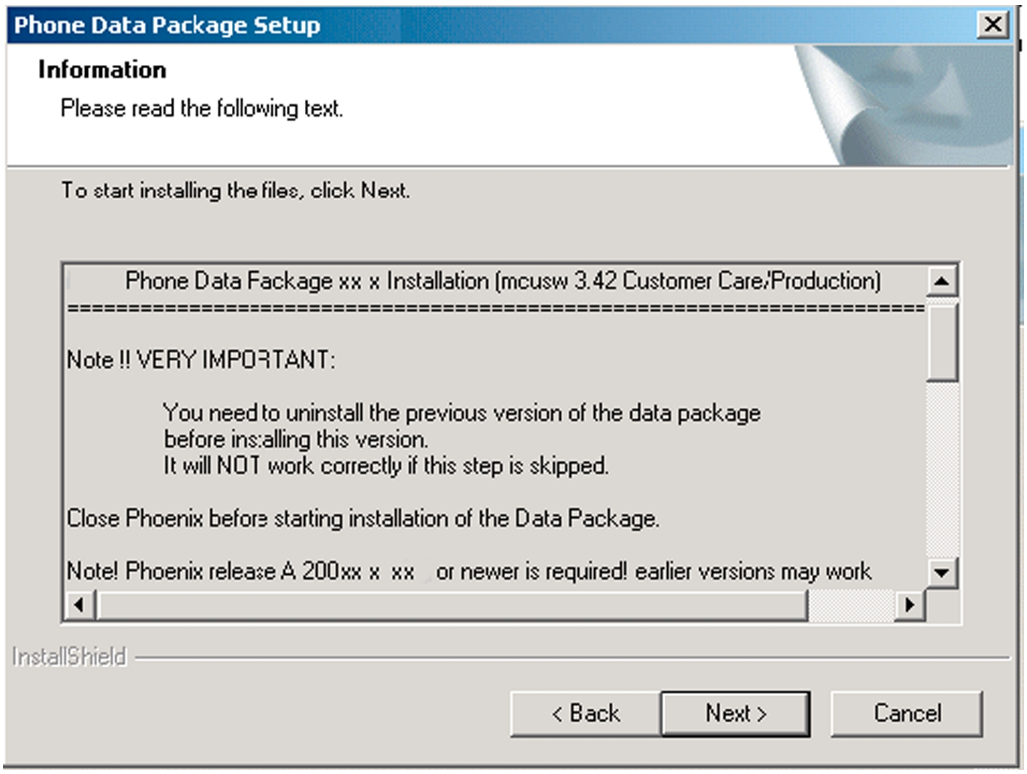
   Wait for the installation files to be extracted.
2. Click **Next**.



Welcome to the InstallShield Wizard for Phone Data Package

The InstallShield® Wizard **x.x** will update **xx-xx** Phone Data Package to version **x.x**. To continue, click Next.

3. In the following view you can see the contents of the data package. Read the text carefully. There is information about the *Phoenix* version required with this data package.



Information

Please read the following text.

To start installing the files, click Next.

Phone Data Package xx x Installation (mcusw 3.42 Customer Care/Production)
==

Note !! VERY IMPORTANT:

You need to uninstall the previous version of the data package
before installing this version.
It will NOT work correctly if this step is skipped.

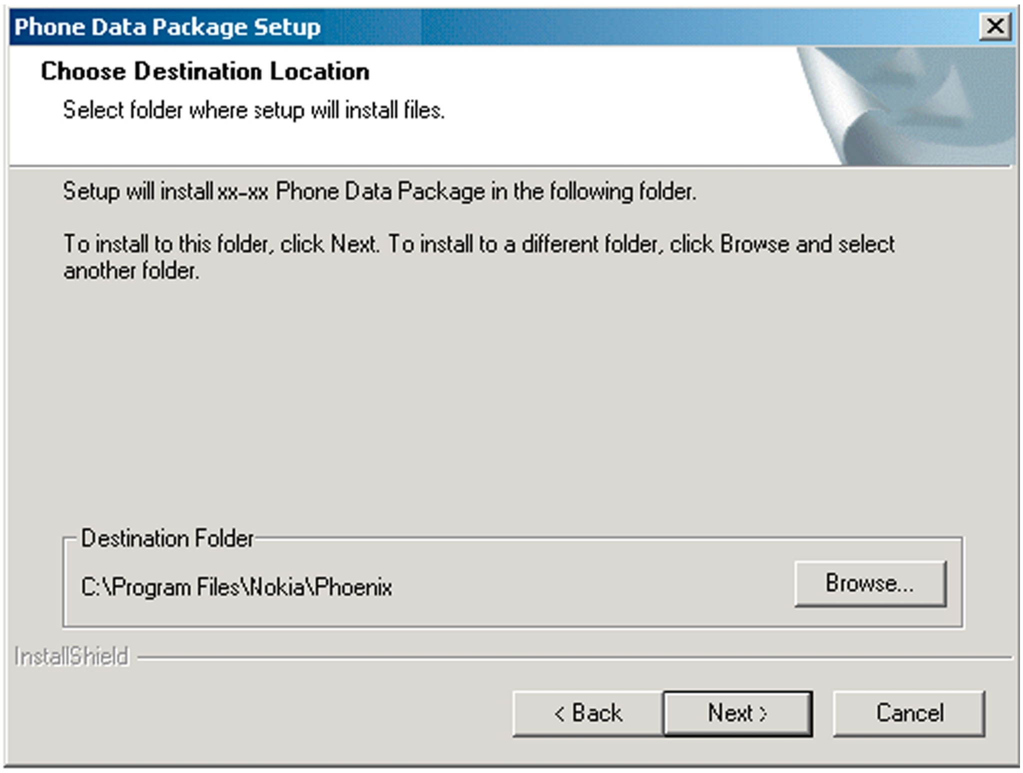
Close Phoenix before starting installation of the Data Package.

Note! Phoenix release A 200xx x xx or newer is required! earlier versions may work

Figure 9 Data package setup information

4. To continue, click **Next**.

5. Choose the destination folder, and click **Next** to continue.



Phone Data Package Setup
Choose Destination Location
Browse...
InstallShield
< Back
Next >
Cancel

Select folder where setup will install files.

Setup will install xx-xx Phone Data Package in the following folder.

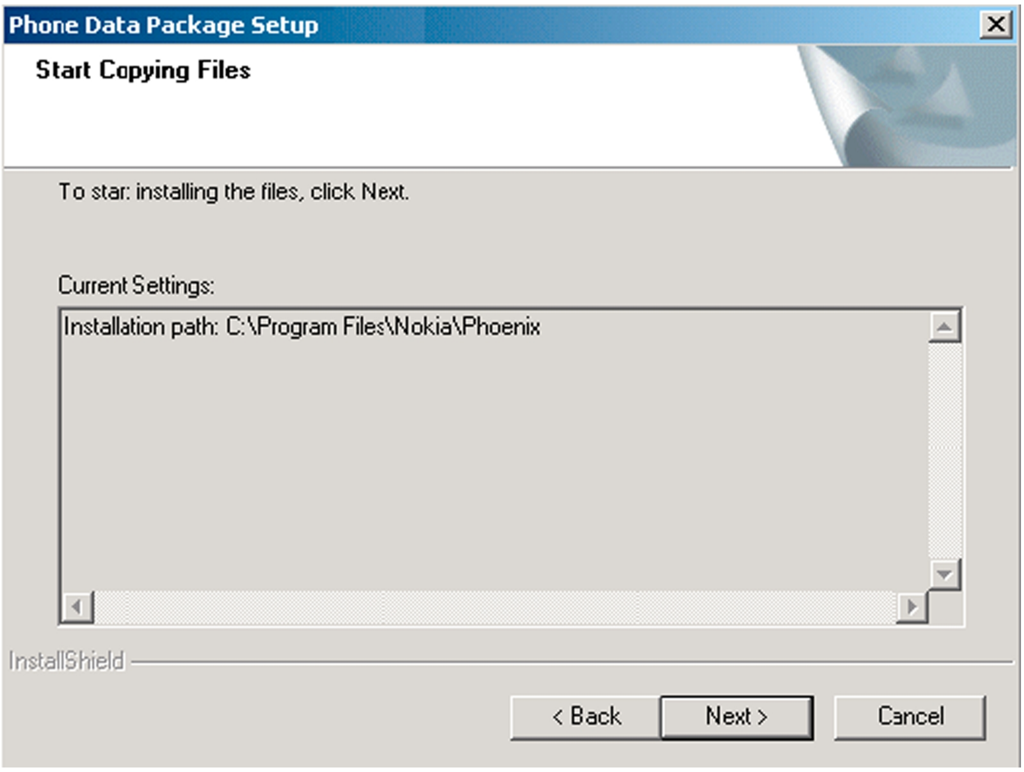
To install to this folder, click Next. To install to a different folder, click Browse and select another folder.

Destination Folder
C:\Program Files\Nokia\Phoenix

Figure 10 Data package destination folder

The InstallShield Wizard checks where *Phoenix* is installed, and the directory is shown.

6. To start copying the files, click **Next**.



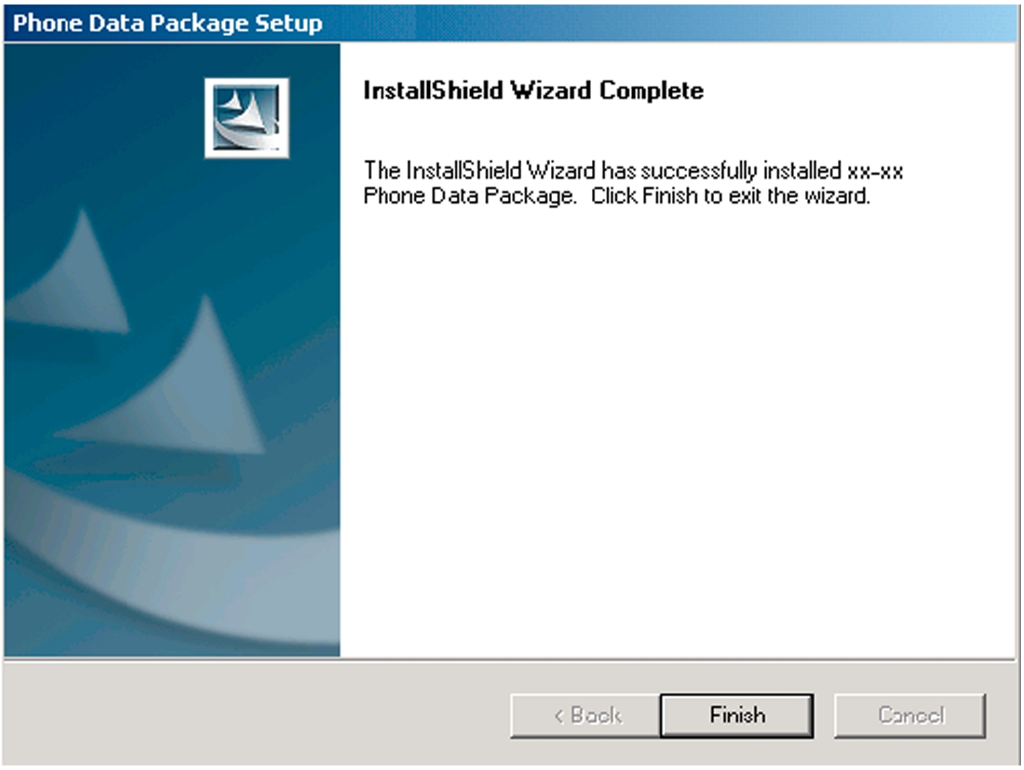
Phone Data Package Setup
Start Copying Files
InstallShield
< Back
Next >
Cancel

To star: installing the files, click Next.

Current Settings:
Installation path: C:\Program Files\Nokia\Phoenix

Phone model specific files are installed. Please wait.

7. To complete the installation, click **Finish**.



InstallShield Wizard Complete

The InstallShield Wizard has successfully installed xx-xx Phone Data Package. Click Finish to exit the wizard.

Figure 11 InstallShield Wizard Complete

Next action

Phoenix can be used for flashing phones and printing type labels after:

- Configuring users
- Managing connections

FPS-8 and FPS-10 can be used after updating their flash update package files.

Uninstalling phone data package

Context

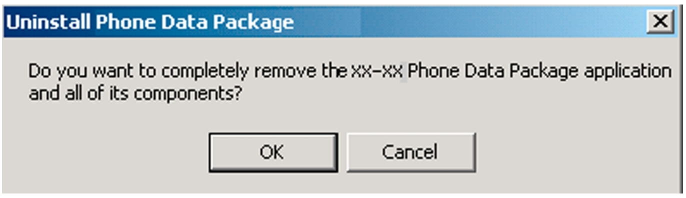
There is no need to uninstall an older version of a data package, unless instructions to do so are given in the *readme.txt* file of the data package and bulletins related to the release.

Please read all related documents carefully.

Steps

1. Locate the data package installation file (e.g. *XX-XX_dp_EA_v_1_0.exe*) from your computer.
2. To start the uninstallation procedure, double-click the data package installation file.

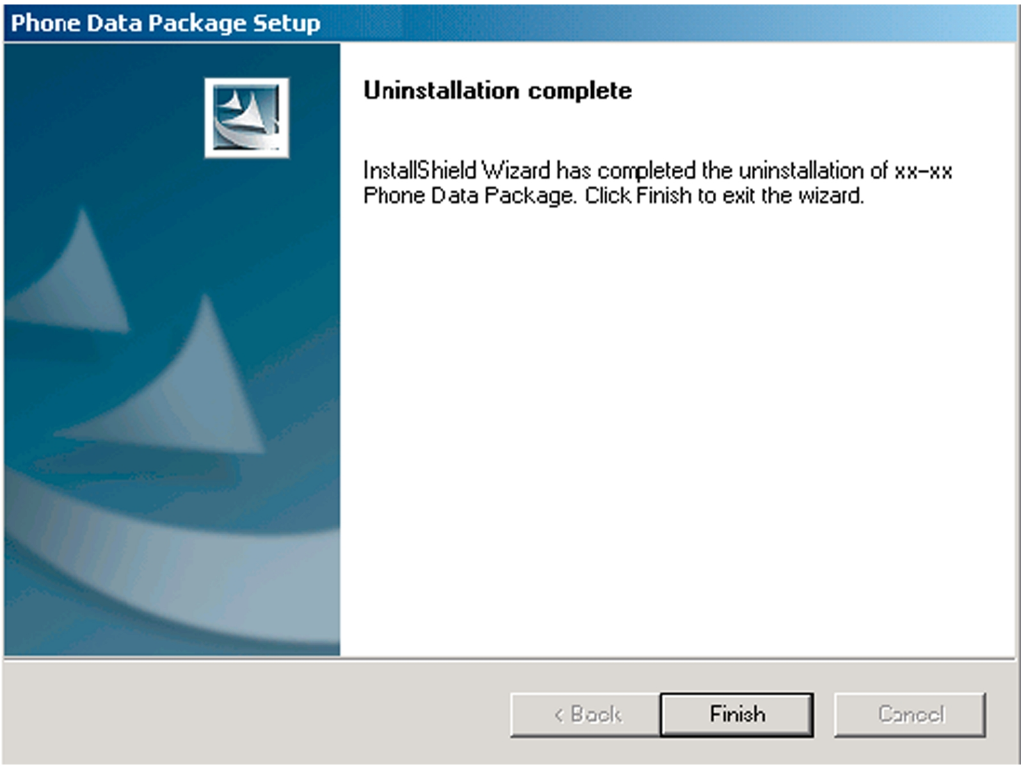
3. To uninstall the data package, click **OK** or to interrupt the uninstallation, click **Cancel**.


Uninstall Phone Data Package
OK
Cancel

Do you want to completely remove the xx-xx Phone Data Package application and all of its components?

Figure 12 Uninstalling phone data package

4. When the data package is uninstalled, click **Finish**.


Phone Data Package Setup
< Back
Finish
Cancel

Uninstallation complete

InstallShield Wizard has completed the uninstallation of xx-xx Phone Data Package. Click Finish to exit the wizard.

Figure 13 Finishing data package uninstallation

Alternative steps

- You can also uninstall the data package manually from **Control Panel→Add/Remove Programs→xx-xx* Phone Data Package** . (*= type designator of the phone).

Configuring users in *Phoenix*

Steps

1. Start *Phoenix* service software, and log in.

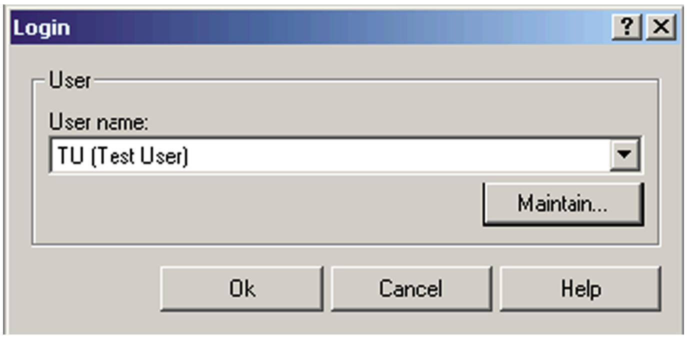


Figure 14 Phoenix login

If the user ID is already configured, select s/he from the *User name* drop-down list, and click **OK**.

2. To add a new user, or to edit existing ones, click **Maintain**.
3. To add a new user, click **New**.
4. Type in the name and initials of the user, and click **OK**.

   The user is added to the user name list.
5. Select the desired user from the *User name* drop-down list, and click **OK**.

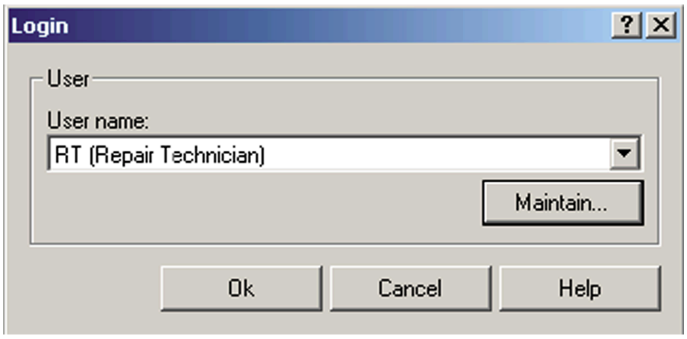


Figure 15 New user configured

Managing connections in *Phoenix*

Context

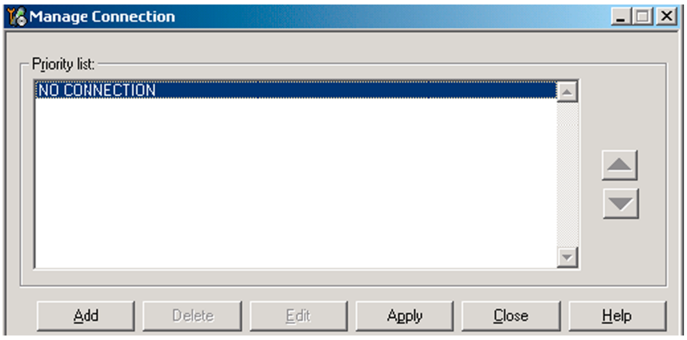
With the **Manage Connections** feature you can edit and delete existing connections or create new ones.

> **Note:** After choosing the desired connection, and connecting the phone to a PC for the first time, allow the PC to install the USB device drivers first. Please note that this may take some time to complete.
>
> If there are problems after the driver installation, check that the USB connection is active from the **Windows Control Panel**. If the problem persists, contact the local PC support.

Steps

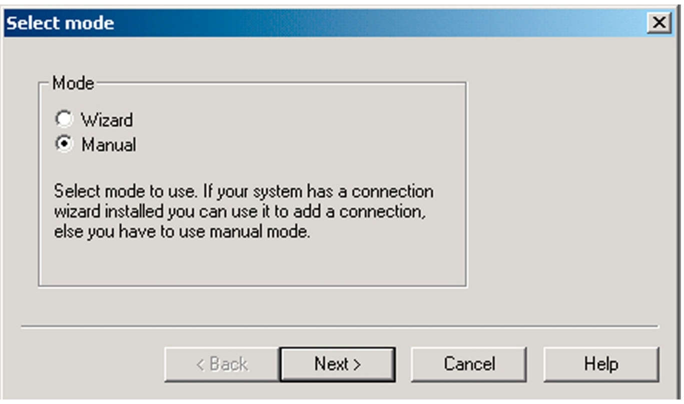
1. Start *Phoenix*, and log in.
2. Choose **File→Manage Connections...** .

3. To add a new connection, click **Add**.



4. Select **Manual** mode, and click **Next** to continue.

   If you want to create the connection using the Connection Wizard, connect the tools and a phone to your PC. The wizard will automatically try to configure the correct connection.



Select mode to use. If your system has a connection wizard installed you can use it to add a connection, else you have to use manual mode.

Figure 16 Select mode: Manual

i For an FPS-10 flash prommer with a **USB Connection**, choose the following connection settings:
- Media: **FPS-10 USB**
- DEVICE_INDEX: **0**
- SERIAL_NUM: See Serial No from the label attached to the bottom of FPS-10
- ACTIVE_MEDIA: **USB**

ii For an FPS-10 flash prommer with a **LAN connection**, choose the following connection settings:
- Media: **FPS-10 TCP/IP**
- NET_SERV_NAME: Click **Scan...**. Choose your own FPS-10 device based on the correct MAC address. See Serial No from the label attached to the bottom of your FPS-10.
- PORT_NUM: Use the default value, and click **Next**.
- PROTOCOL_FAMILY: Use the default value, and click **Next**.
- SOCKET TYPE: Use the default value, and click **Next**.
- TX_BUFFER_SIZE: Use the default value, and click **Next**.
- RX_BUFFER_SIZE: Use the default value, and click **Next**.

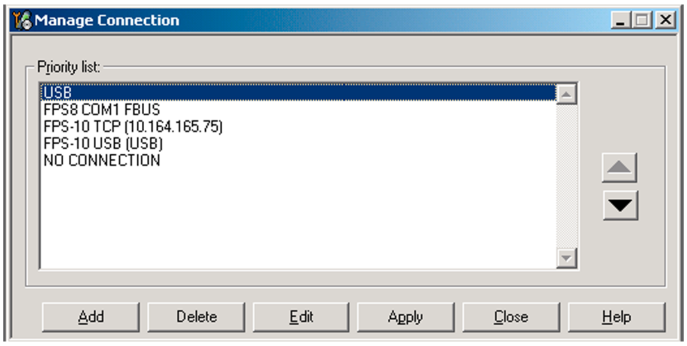
iii For an FPS-8 flash prommer, choose the following connection settings:
- Media: FPS-8
- PORT_NUM: COM Port where FPS-8 is connected
- COMBOX_DEF_MEDIA: **FBUS**

iv For a plain **USB connection**, choose the following connection settings:

Note: First connect the DKU-2 USB cable between the PC USB port and phone.

- Media: USB

5. To complete the configuration, click **Finish**.
6. Click the connection you want to activate. Use the up/down arrows located on the right hand side to move it on top of the list, then click **Apply**.



USB
FPS8 COM1 FBUS
FPS-10 TCP (10.164.165.75)
FPS-10 USB (USB)
NO CONNECTION

Figure 17 Connections list

The connection is activated, and it can be used after closing the *Manage Connection* window.

The connection information is shown at the right hand bottom corner of the screen.

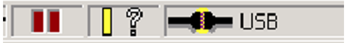
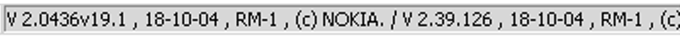


Figure 18 Connection information

7. To use the connection, connect the phone to your PC with correct service tools. Make sure the phone is switched on, and then choose **File→Scan Product** .

Results

The product support module information appears in the status bar:



V 2.0436v19.1 , 18-10-04 , RM-1 , (c) NOKIA. / V 2.39.126 , 18-10-04 , RM-1 , (c)

Figure 19 Product support module information (example from RM-1)

Installing flash support files for FPS-8 and FPS-10

Before you begin

- Install *Phoenix* service software.
- Install phone model specific data package for *Phoenix*.
- If you want to update the flash support files, they are delivered in the same installation package with *Phoenix* or newer *Phoenix* packages beginning from December 2004.

  In case you want to update the MCU files, install the latest data package (see Technical Bulletins for information on the latest one).

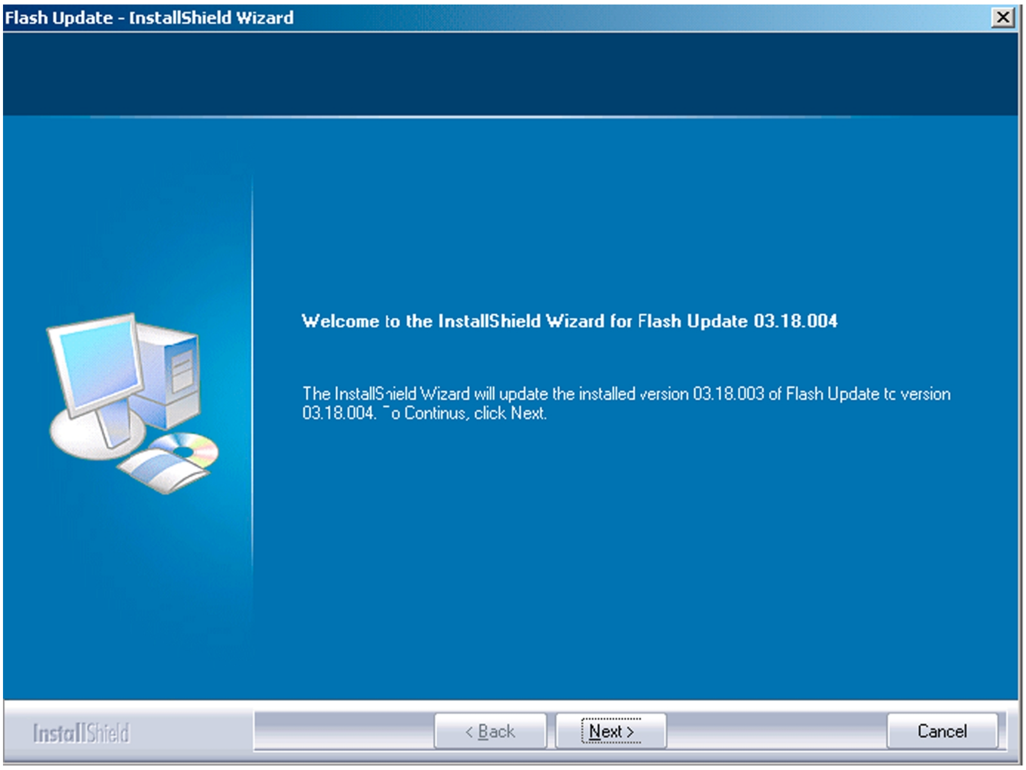
  Normally, it is enough to install *Phoenix* and the phone-specific data package because the installation always includes the latest flash update package files for FPS-8 and FPS-10.
- A separate installation package for flash support files is available. The files can be updated according to these instructions, if updates appear between *Phoenix* data package releases.

Context

If you are not using a separate installation package, you can skip this section and continue with "Updating FPS-8 and FPS-10 flash prommer software,, (page 3–23) after installing a new phone data package.

Steps

1. To begin the installation, double-click the flash update file (for example, *flash_update_03_183_0014.exe*).



Welcome to the InstallShield Wizard for Flash Update 03.18.004

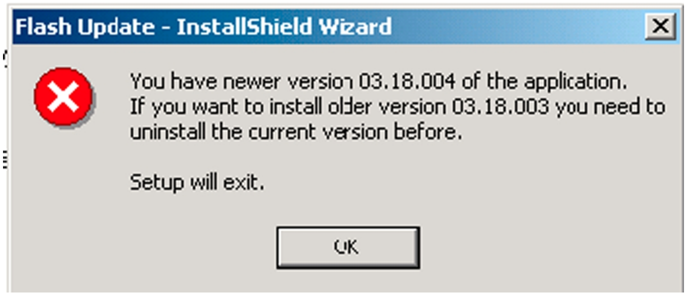
The InstallShield Wizard will update the installed version 03.18.003 of Flash Update to version 03.18.004. To Continue, click Next.

Figure 20 Flash update welcome dialog

   If the same version of the flash update package already exists, and you want to reinstall it, the previous package is first uninstalled.

   Restart installation again after the uninstallation.

2. If you try to downgrade the existing version to older ones, the setup will be aborted. If there is a need to downgrade the version, uninstall newer files manually from the **Windows Control Panel**, and then rerun the installation.



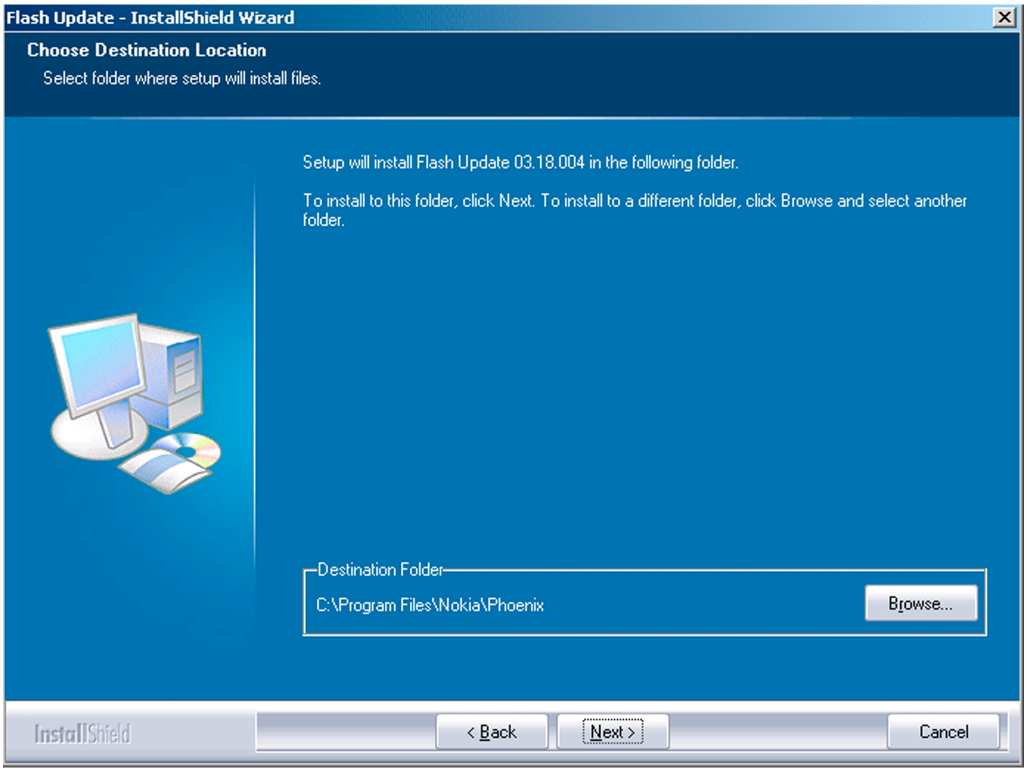
You have newer version 03.18.004 of the application.
If you want to install older version 03.18.003 you need to uninstall the current version before.

Setup will exit.

Figure 21 Flash installation interrupted

If an older version exists on your PC and it needs to be updated, click **Next** to continue installation.

3. It is recommended to install the files to the default destination folder *C:|Program Files|Nokia|Phoenix*. To continue, click **Next**.



Flash Update - InstallShield Wizard

Choose Destination Location

Select folder where setup will install files.

Setup will install Flash Update 03.18.004 in the following folder.

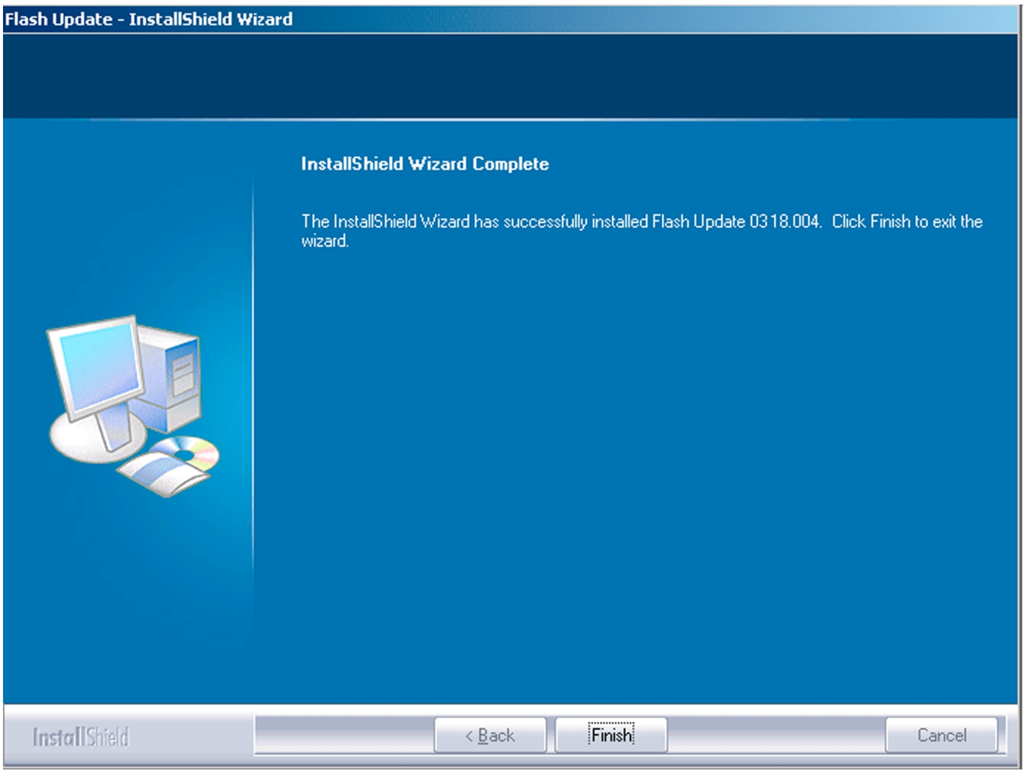
To install to this folder, click Next. To install to a different folder, click Browse and select another folder.

Destination Folder: C:\Program Files\Nokia\Phoenix

Figure 22 Flash destination folder

When installing the flash update files for the first time, you may choose another location by selecting **Browse** (not recommended).

4. To complete the installation procedure, click **Finish** .



Flash Update - InstallShield Wizard

InstallShield Wizard Complete

The InstallShield Wizard has successfully installed Flash Update 0318.004. Click Finish to exit the wizard.

Figure 23 Finish flash update

Next action

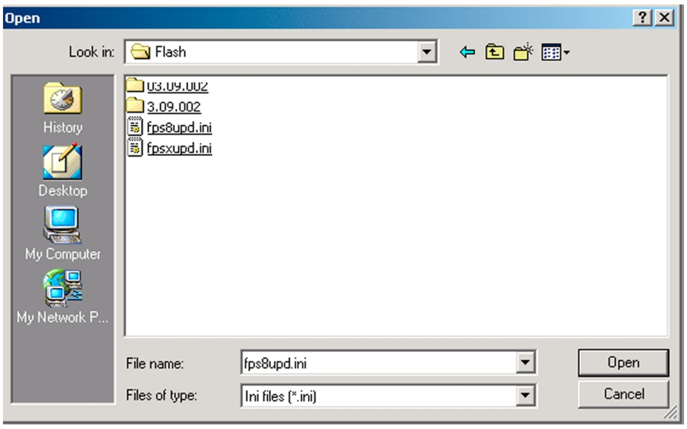
FPS-8 and FPS-10 flash prommers must be updated using *Phoenix*.

Updating FPS-8 and FPS-10 flash prommer software

Steps

1. Start *Phoenix* service software, and log in.
2. Choose the correct connection for your flash prommer: **File→Manage Connections...**
3. Choose **Flashing→Prommer maintenance** .

4. To update the **FPS-8/FPS-10** software, click **Update**, and select the appropriate file *fps8upd.ini* (for FPS-8) or *fpsxupd.ini* (for FPS-10) from *C:|Program Files|Nokia|Phoenix|Flash*.


Open
Look in:
Flash
History
Desktop
My Computer
My Network P...
03.09.002
3.09.002
fps8upd.ini
fpsxupd.ini
Open
Cancel

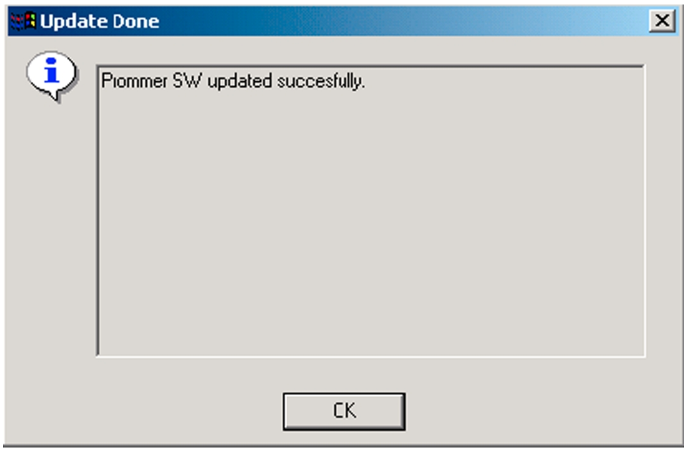
File name: fps8upd.ini

Files of type: Ini files (*.ini)

Figure 24 Flash directory window

Tip: All files can be loaded separately to the prommer used. To do this, click the right mouse button in the *Flash Box Files* pane and select the file type(s) to be loaded.

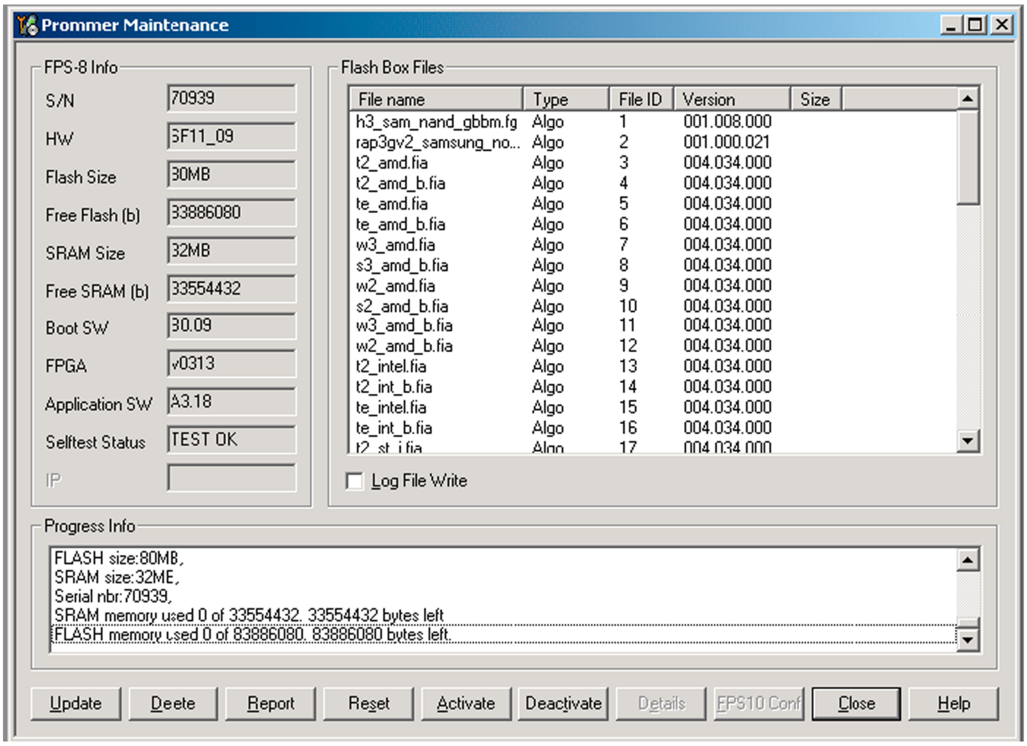
5. Click **OK**.


Update Done
OK

Prommer SW updated succesfully.

Figure 25 Prommer software update finished

6. To close the *Prommer Maintenance* window, click **Close**.



S/N 70939
HW 5F11_09
Flash Size 30MB
Free Flash (b) 33886080
SRAM Size 32MB
Free SRAM (b) 33554432
Boot SW 30.09
FPGA v0313
Application SW A3.18
Selftest Status TEST OK
IP

File name	Type	File ID	Version	Size
h3_sam_nand_gbbm.fg	Algo	1	001.008.000	
rap3gv2_samsung_no...	Algo	2	001.000.021	
t2_amd.fia	Algo	3	004.034.000	
t2_amd_b.fia	Algo	4	004.034.000	
te_amd.fia	Algo	5	004.034.000	
te_amd_b.fia	Algo	6	004.034.000	
w3_amd.fia	Algo	7	004.034.000	
s3_amd_b.fia	Algo	8	004.034.000	
w2_amd.fia	Algo	9	004.034.000	
s2_amd_b.fia	Algo	10	004.034.000	
w3_amd_b.fia	Algo	11	004.034.000	
w2_amd_b.fia	Algo	12	004.034.000	
t2_intel.fia	Algo	13	004.034.000	
t2_int_b.fia	Algo	14	004.034.000	
te_intel.fia	Algo	15	004.034.000	
te_int_b.fia	Algo	16	004.034.000	
t2_st_i.fia	Algo	17	004.034.000	

```
FLASH size:80MB,
SRAM size:32ME,
Serial nbr:70939,
SRAM memory used 0 of 33554432. 33554432 bytes left
FLASH memory used 0 of 83886080. 83886080 bytes left.
```

Figure 26 *Prommer Maintenance* window

Activating FPS-8

Context

Before FPS-8 can be successfully used for phone programming, it must first be activated.

First fill in the *FPS-8 activation request* sheet in the FPS-8 sales package, and follow the instructions given.

When activation file is received (for example, *00000.in*), copy it to the *C:|ProgramFiles|Nokia|Phoenix |BoxActivation* directory on your computer (this directory is created when *Phoenix* is installed).

Steps

1. Start *Phoenix* service software.
2. Choose **Flashing→Prommer Maintenance** .
3. In the *Prommer Maintenance* window, click **Activate**.
4. To find the activation file, click **Browse**.

5. To activate the prommer, select the activation file and click **Open**.

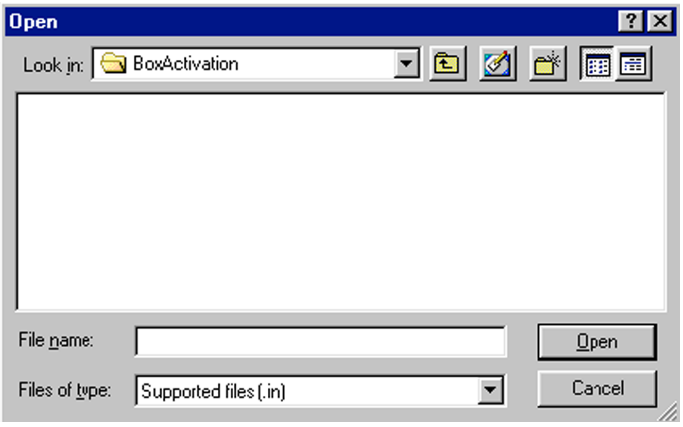

Open
Look in:
BoxActivation
File name:
Files of type:
Supported files (.in)
Open
Cancel

Figure 27 Box activation

6. To complete the activation, restart FPS-8.

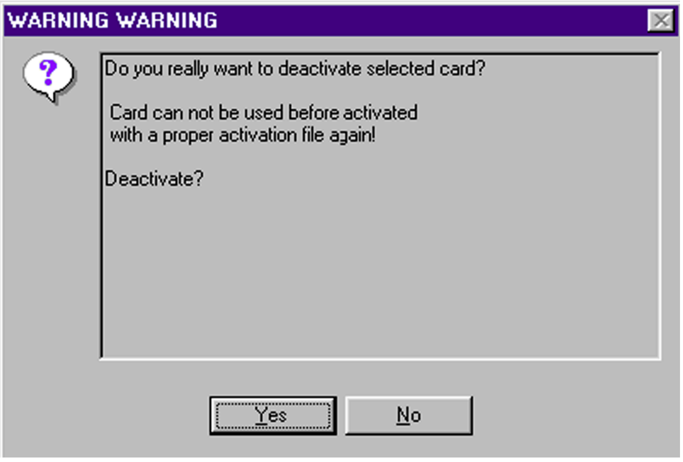
Deactivating FPS-8

Context

If there is, for example, a need to send the FPS-8 box for repair, it must be deactivated first.

Steps

1. Start *Phoenix* service software.
2. Choose **Flashing→Prommer Maintenance** .
3. In the *Prommer Maintenance* window, click **Deactivate**.
4. To confirm the deactivation, click **Yes**.


WARNING WARNING

Do you really want to deactivate selected card?

Card can not be used before activated
with a proper activation file again!

Deactivate?

Figure 28 Deactivation warning

The box is deactivated.

5. To complete the deactivation, restart FPS-8.

4 — Service Tools and Service Concepts

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- JBT-9......4–8
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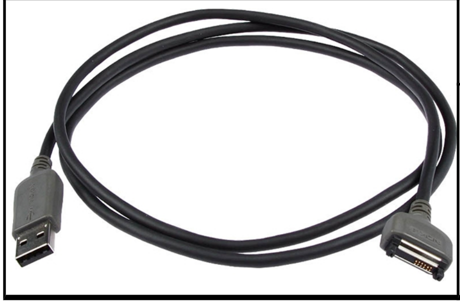
Service tools

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-56, refer to various concepts.

	CA-35S	Power cable	
	CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.		
	CA-53	USB connectivity cable	
	USB to Pop-Port^{TM} connector cable.		

CU-4	Control unit	

CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.

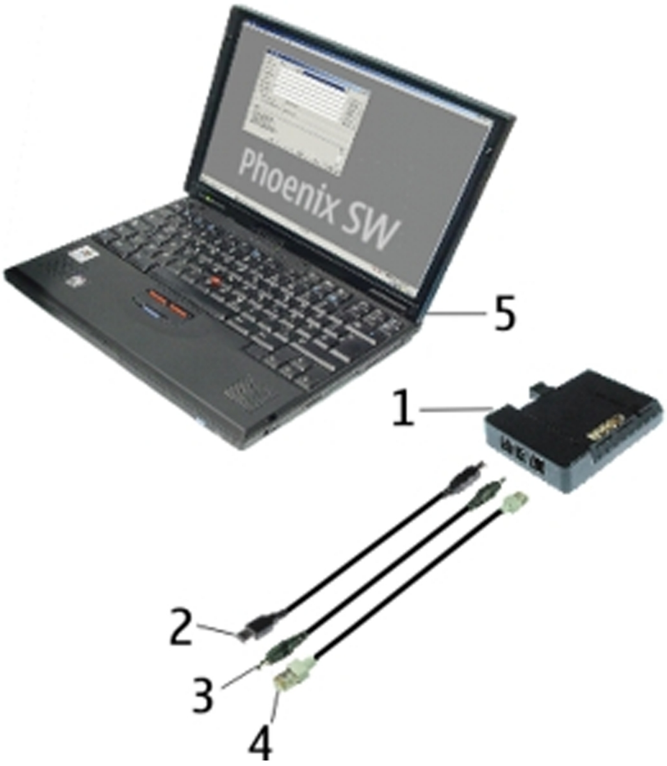
The unit has the following features:

- software controlled via USB
- EM calibration function
- Forwards FBUS/Flashbus traffic to/from terminal
- Forwards USB traffic to/from terminal
- software controlled BSI values
- regulated VBATT voltage
- 2 x USB2.0 connector (Hub)
- FBUS and USB connections supported

When using CU-4, note the special order of connecting cables and other service equipment:

Instructions

1. Connect a service tool (jig, flash adapter) to CU-4.
2. Connect CU-4 to your PC with a USB cable.
3. Connect supply voltage (12 V)
4. Connect an FBUS cable (if necessary).
5. Start Phoenix service software.



Note: Phoenix enables CU-4 regulators via USB when it is started.

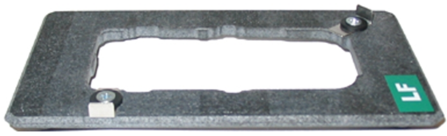
Reconnecting the power supply requires a Phoenix restart.

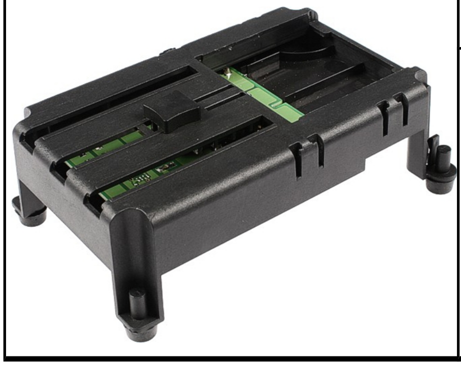
<table>
<tr><td rowspan="2"> </td><td>DKU-2</td><td>USB connectivity cable</td><td></td></tr>
<tr><td colspan="3">USB to system connector cable.</td></tr>
<tr><td rowspan="2">

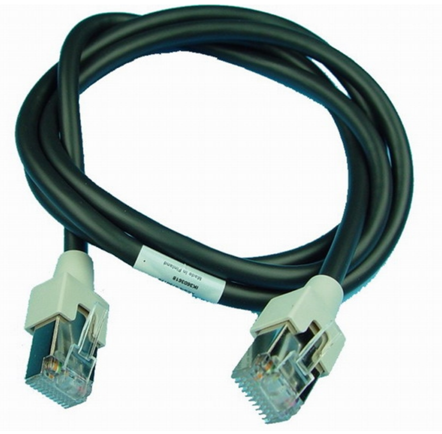
NOKIA
FLS-4S

</td><td>FLS-4S</td><td>Flash device</td><td></td></tr>
<tr><td colspan="3">FLS-4S is a dongle and flash device incorporated into one package, developed specifically for POS use.</td></tr>
</table>

<table>
<tr><td rowspan="2"> </td><td>FPS-10</td><td>Flash prommer</td><td></td></tr>
<tr><td colspan="3">FPS-10 interfaces with:
• PC
• Control unit
• Flash adapter
• Smart card
FPS-10 flash prommer features:
• Flash functionality for BB5 and DCT-4 terminals
• Smart Card reader for SX-2 or SX-4
• USB traffic forwarding
• USB to FBUS/Flashbus conversion
• LAN to FBUS/Flashbus and USB conversion
• Vusb output switchable by PC command
FPS-10 sales package includes:
• FPS-10 prommer
• Power Supply with 5 country specific cords
• USB cable</td></tr>
<tr><td rowspan="2"> </td><td>FS-12</td><td>product specific adapter</td><td></td></tr>
<tr><td colspan="3">Flash adapter FS-12 is used for phone testing and flashing. FS-14 is used with the generic flash adapter base and control Unit CU-4 or interface adapter.
When flashing or system testing the phone, the adapter is attached to replace the phone own battery. All functions (as well as the calibration voltages, current and the protections for over voltages, over current and voltage polarity), are performed by CU-4.</td></tr>
<tr><td rowspan="2"> </td><td>JBT-9</td><td>Bluetooth test and interface box (sales package)</td><td></td></tr>
<tr><td colspan="3">The JBT-9 test box is a generic service device used to perform Bluetooth bit error rate (BER) testing, and establishing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and an AXS-4 cable in case of cordless interface usage testing .
Sales package includes:
• JBT-9 test box
• Installation and warranty information</td></tr>
</table>

	MJ-69	Module jig	
	MJ-69 is meant for component level troubleshooting. The jig includes an RF interface for GSM, WCDMA and Bluetooth. In addition, it has the following features: • Provides mechanical interface with Engine module • Provides galvanic connection to all needed test pads in module • Multiplexing between USB and FBUS media, controlled by Vusb • UI test interface • MMC interface • Duplicated SIM connector • Audio components: IHF, MIC, earpiece • Connector for control unit • Access for Pop-Port™ system connector **Note:** In the picture CU-4 is connected to MJ-69 . CU-4 is not part of the MJ-69 sales package and has to be ordered separately.		
	PCS-1	Power cable	
	The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled operating voltage.		
	PKD-1	SW security device	
	SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC. Without the device, it is not possible to use the service software. Printer or any such device can be connected to the PC through the device if needed.		
	RJ-76	Soldering jig	
	RJ-76 is a soldering jig used for soldering and as a rework jig for the engine module.		

<table>
<tr><td rowspan="2"> </td><td>RJ-93</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-93 is used as a rework jig for the engine module.
This stencil takes the front end module (FEM) or power amplifier (PA) module for spreading the soldering paste to the component. Must be used together with the ST-40 stencil.</td></tr>
<tr><td rowspan="2"> </td><td>SA-84</td><td>RF coupler</td><td></td></tr>
<tr><td colspan="3">SA-84 is a coupler for GSM RF testing. It is used together with FS-12 flash adapter.</td></tr>
<tr><td rowspan="2"> </td><td>SS-46</td><td>Interface adapter</td><td></td></tr>
<tr><td colspan="3">SS-46 acts as an interface adapter between a product-specific flash adapter and FPS-10.</td></tr>
<tr><td rowspan="2"></td><td>SS-62</td><td>jig</td><td></td></tr>
<tr><td colspan="3"></td></tr>
</table>

<table>
<tr><td rowspan="2"></td><td>XCS-4</td><td>Modular cable</td><td></td></tr>
<tr><td colspan="3">XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.</td></tr>
<tr><td rowspan="2"> </td><td>XRF-1</td><td>RF cable</td><td></td></tr>
<tr><td colspan="3">The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment.
SMA to N-Connector ca. 610mm.
Attenuation for:
• GSM850/900: 0.3+-0.1 dB
• GSM1800/1900: 0.5+-0.1 dB
• WLAN: 0.6+-0.1dB</td></tr>
</table>

Service concepts

Flash concept with FPS-10

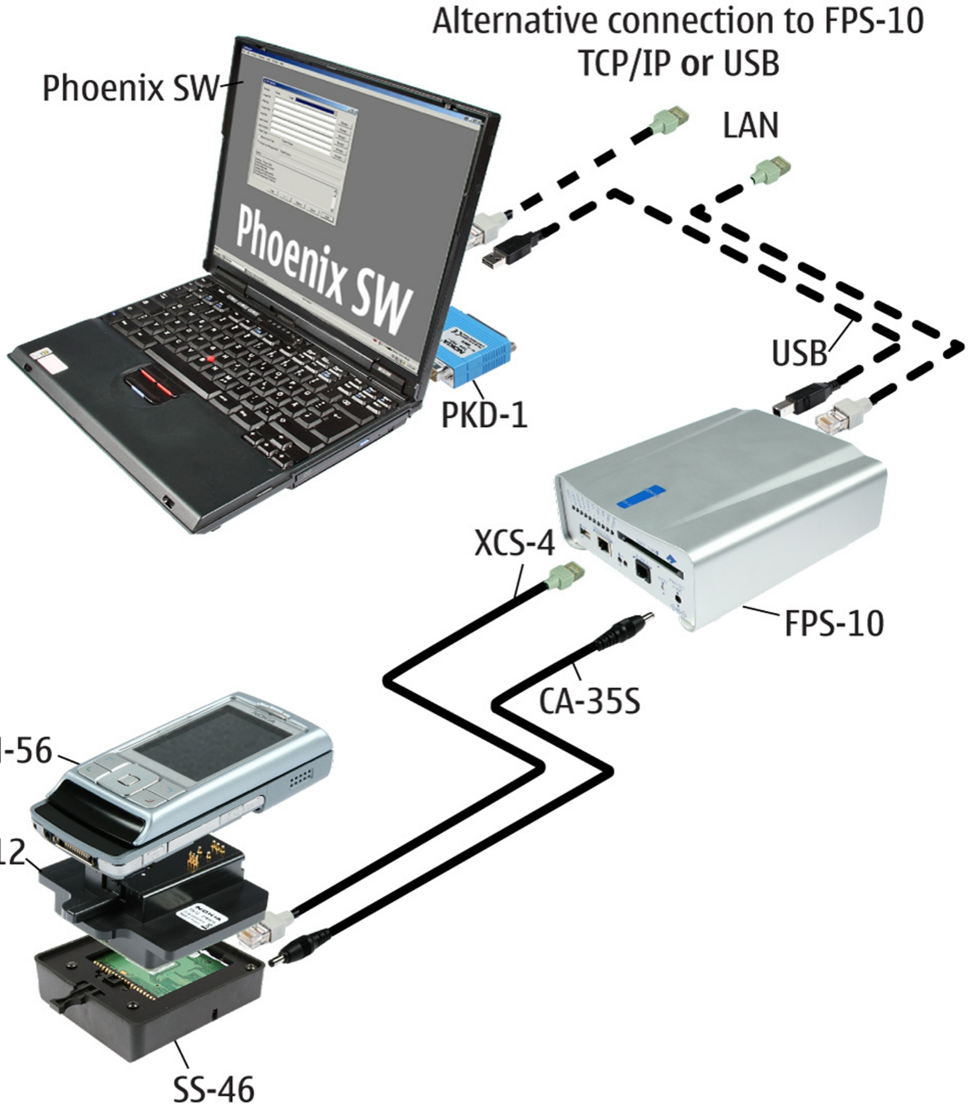

Alternative connection to FPS-10
TCP/IP or USB
Phoenix SW
Phoenix SW
LAN
USB
PKD-1
XCS-4
FPS-10
CA-35S
RM-56
FS-12
SS-46

Figure 29 Basic flash concept with FPS-10

Description	Type
FS-12	Flash adapter
SS-46	Interface adapter
CA-35S	Power cable
XCS-4	Modular cable
FPS-10	Flash prommer box
	Standard USB cable
PKD-1	SW security device

Flash concept with FPS-10 (USB)

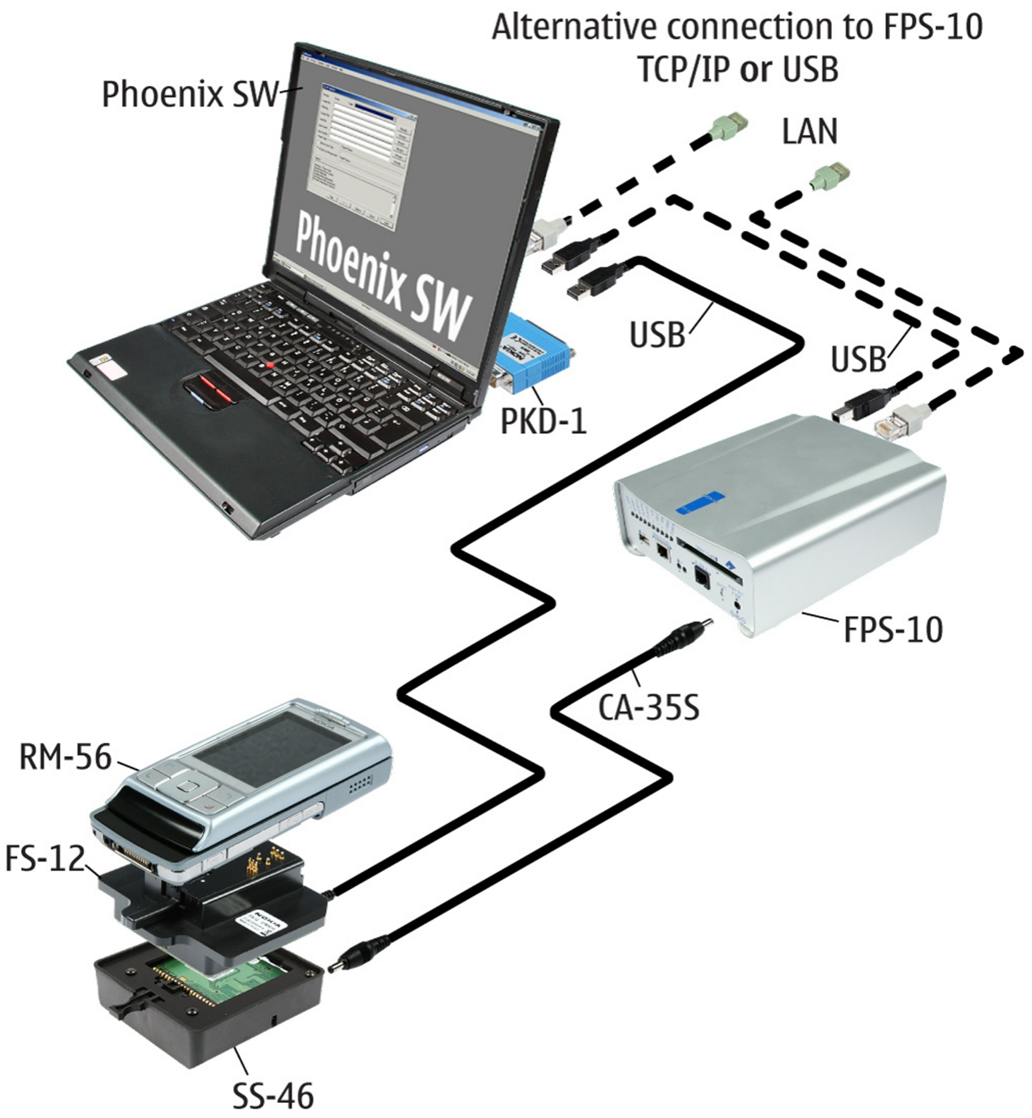

Alternative connection to FPS-10
TCP/IP or USB
Phoenix SW
LAN
USB
USB
PKD-1
FPS-10
CA-35S
RM-56
FS-12
SS-46

Figure 30 Flash concept with FPS-10

Description	Type
FS-12	Flash adapter
SS-46	Interface adapter
CA-35S	Power cable
	USB cable
FPS-10	Flash prommer box
	Standard USB cable
PKD-1	SW security device

MJ-69 module jig concept

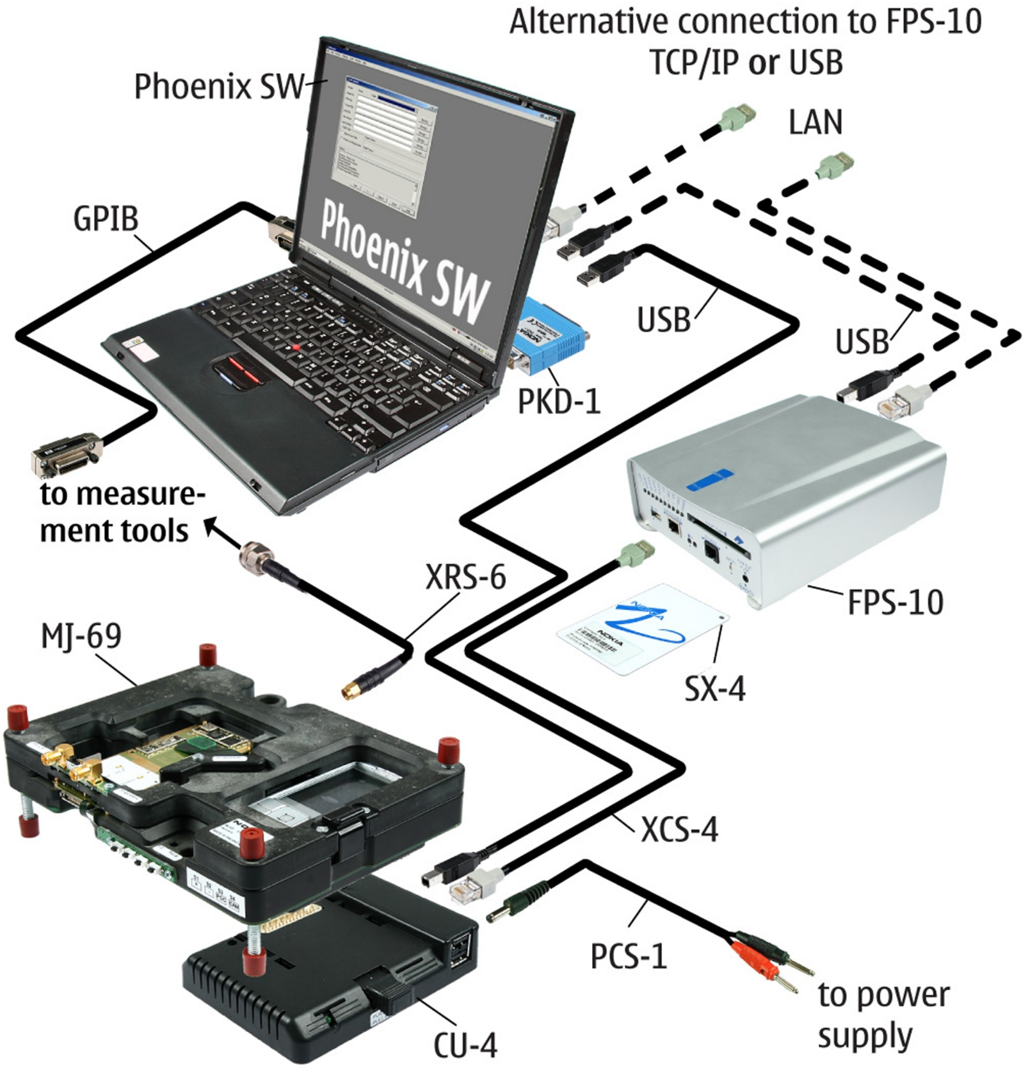

Alternative connection to FPS-10
TCP/IP or USB
Phoenix SW
LAN
GPIB
USB
USB
PKD-1
to measure-
ment tools
XRS-6
FPS-10
MJ-69
SX-4
XCS-4
PCS-1
to power
supply
CU-4

Figure 31 MJ-69 module jig service concept

Type	Description
MJ-69	Module jig
CU-4	Control unit
FPS-10	Flash prommer
SX-4	Smart card
XCS-4	Modular cable
PCS-1	DC power cable
	Standard USB cable
	Standard USB cable
	GPIB control cable
XRS-6	RF cable

Type	Description
PKD-1	SW security device

POS (Point of Sale) flash concept

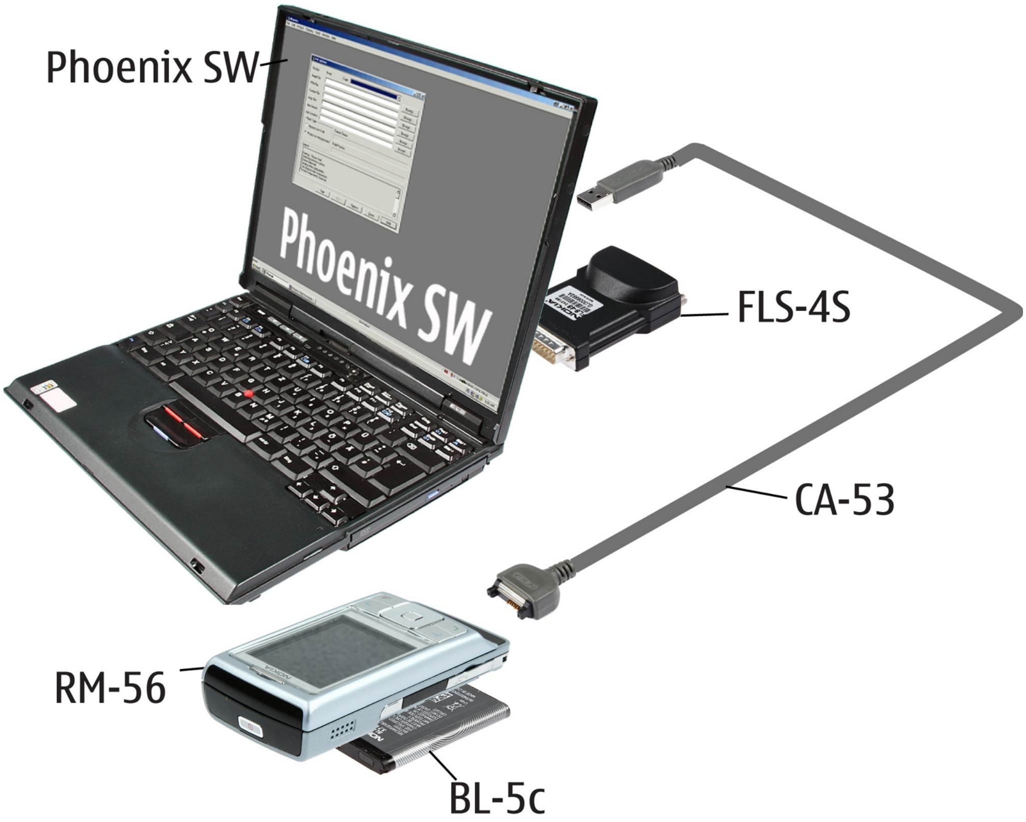

Phoenix SW
Phoenix SW
FLS-4S
CA-53
RM-56
BL-5c

Figure 32 POS flash concept

Type	Description
CA-53	Cable
FLS-4S	POS flash dongle

Service concept for RF testing and RF/BB tuning

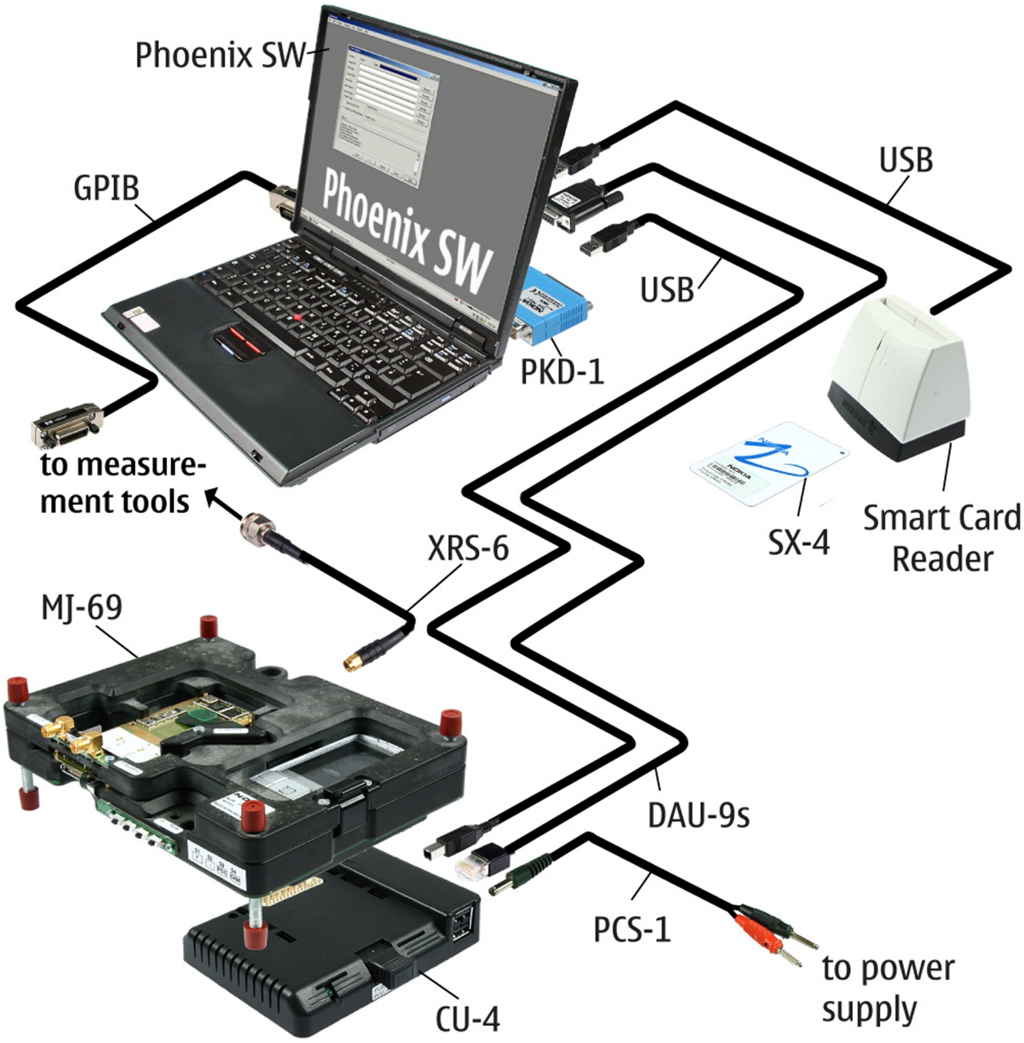

Phoenix SW
Phoenix SW
GPIB
USB
USB
PKD-1
to measure-
ment tools
XRS-6
SX-4
Smart Card
Reader
MJ-69
DAU-9s
PCS-1
to power
supply
CU-4

Figure 33 Service concept for RF testing and RF/BB tuning

Description	Type
MJ-69	Module jig
CU-4	Control unit
	Standard USB cable
PCS-1	DC power cable
	Standard USB cable + smart card reader
SX-4	Smart card
XRS-6	RF cable
	GPIB control cable
PKD-1	SW security device

CU-4 flash concept with FPS-10

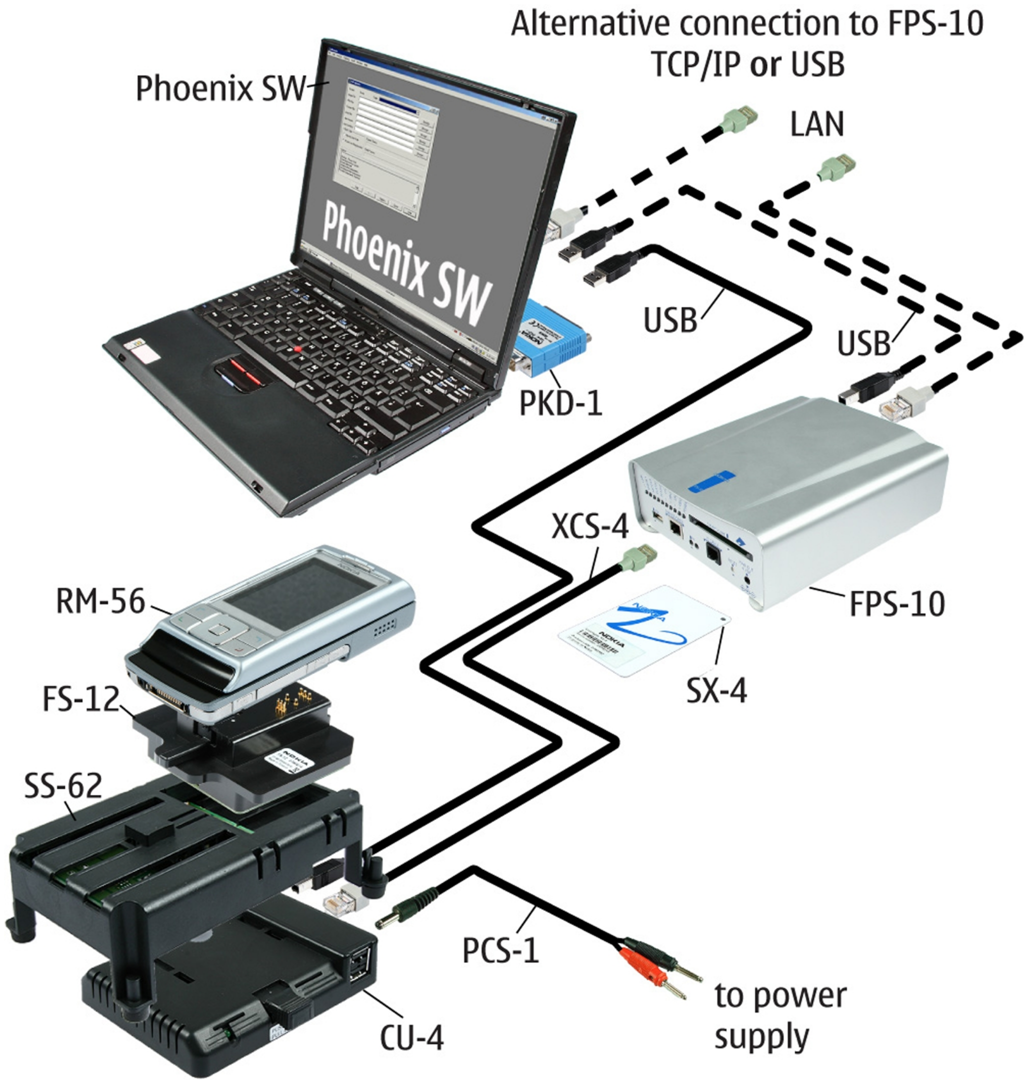

Alternative connection to FPS-10
TCP/IP or USB
LAN
Phoenix SW
Phoenix SW
USB
USB
PKD-1
XCS-4
FPS-10
SX-4
RM-56
FS-12
SS-62
PCS-1
to power supply
CU-4

Figure 34 CU-4 flash concept with FPS-10

Description	Type
FS-12	Flash adapter
CU-4	Control unit
PCS-1	Power cable
XCS-4	Modular cable
FPS-10	Flash prommer box
SS-62	Jig
	Standard USB cable
	Standard USB cable
PKD-1	SW security device

RF testing concept with RF coupler

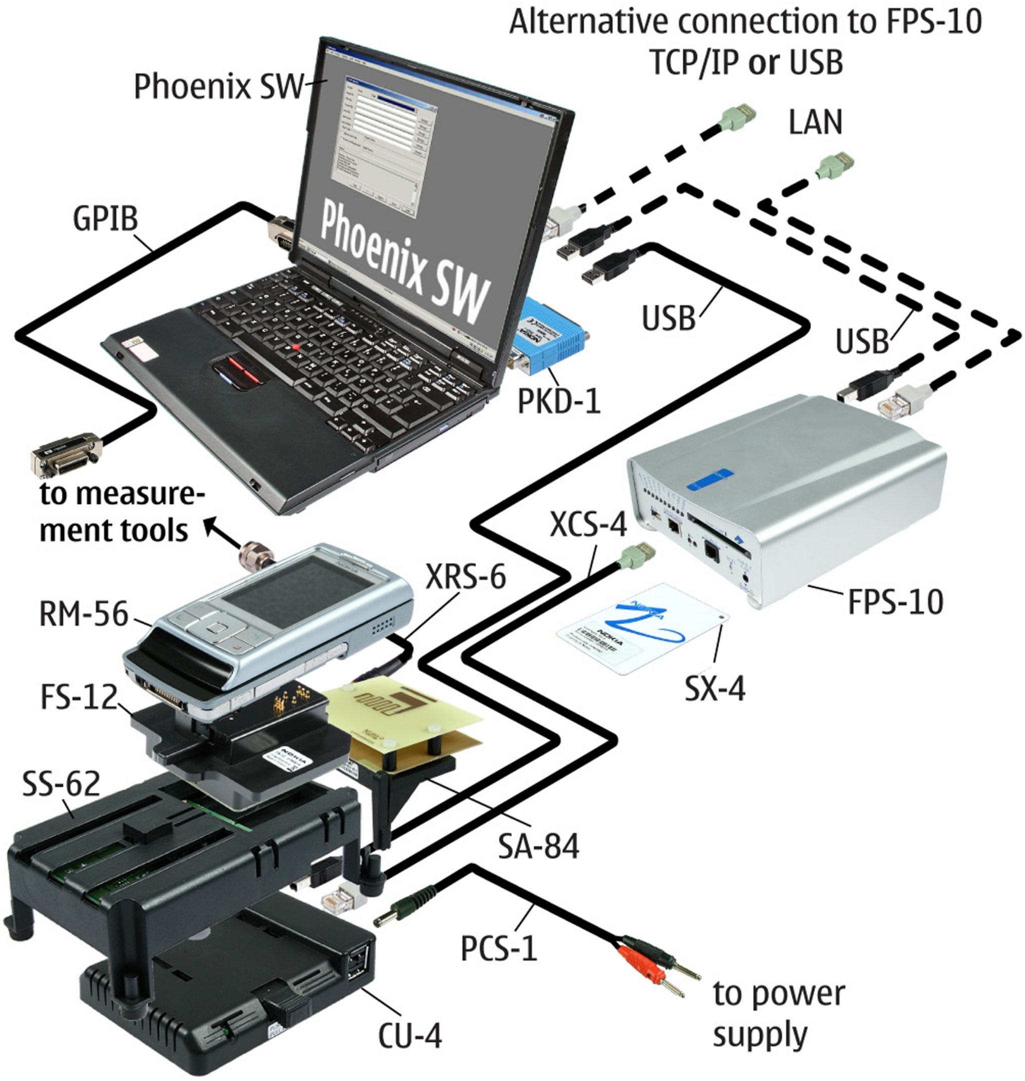

Alternative connection to FPS-10
TCP/IP or USB
Phoenix SW
LAN
GPIB
Phoenix SW
USB
USB
PKD-1
to measure-
ment tools
XCS-4
RM-56
XRS-6
FPS-10
FS-12
SX-4
SS-62
SA-84
PCS-1
to power
supply
CU-4

Figure 35 RF testing concept with RF coupler

Type	Description
FS-12	Flash adapter
CU-4	Control unit
SA-84	RF coupler
PCS-1	Power cable
XCS-4	Cable
SS-62	Jig
	Standard USB cable
	Standard USB cable + smart card reader
SX-4	Smart card
	GPIB control cable

Type	Description
XRS-6	RF cable
PKD-1	SW security device

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5 — Disassembly / Reassembly Instructions

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Table of Contents

Disassembly instructions (upper part)........5–5
Disassembly instructions (lower part)........5–11

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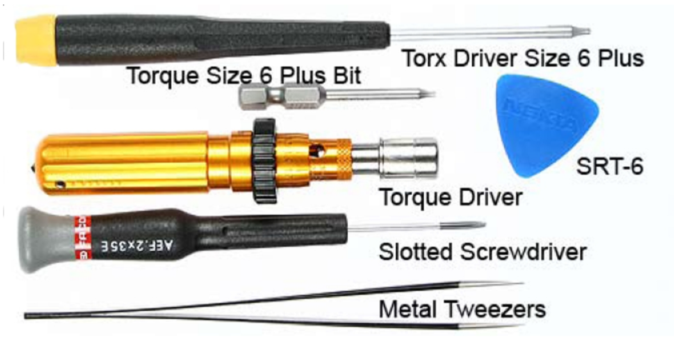
Disassembly instructions (upper part)

Before you begin

- Reassembly takes place in the reverse order.

Steps

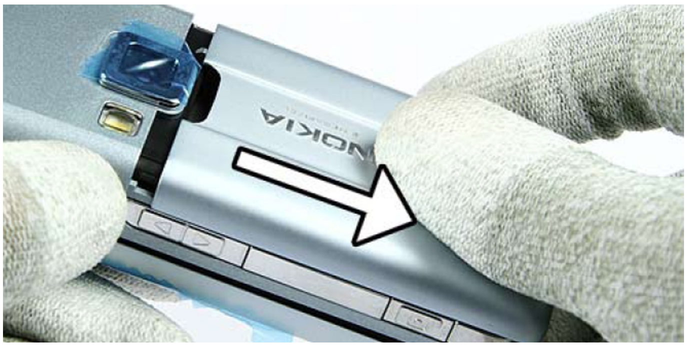
1. Use these tools for disassembly and reassembly.


Torx Driver Size 6 Plus
Torque Size 6 Plus Bit
SRT-6
Torque Driver
Slotted Screwdriver
Metal Tweezers

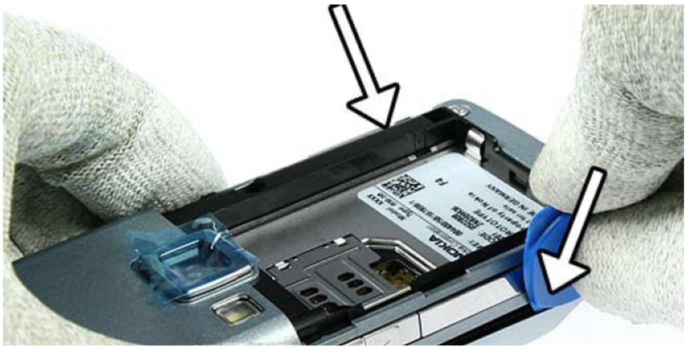
2. Protect the window with a plastic film.

3. Protect the camera window with a plastic film.

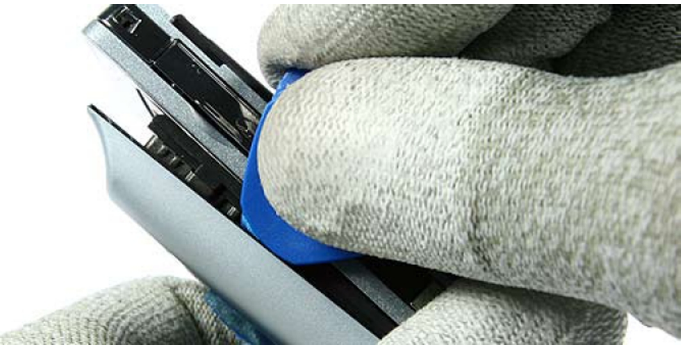
4. Remove the **Battery Cover**. Ensure that no battery is still inserted.



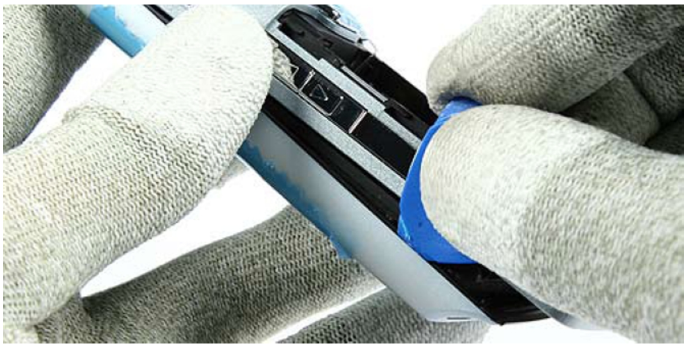
5. Carefully release the shown plastic clips from the bottom side.



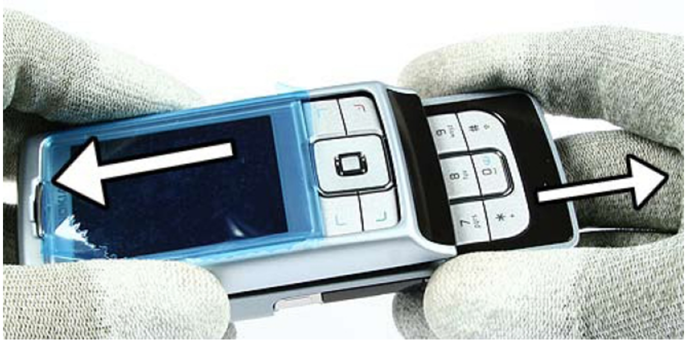
6. Prevent scratching the surfaces. Do not shift the SRT-6 along the sides.



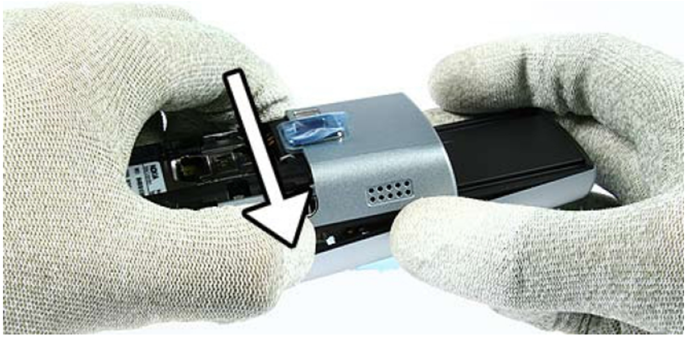
7. Continue on the opposite side.



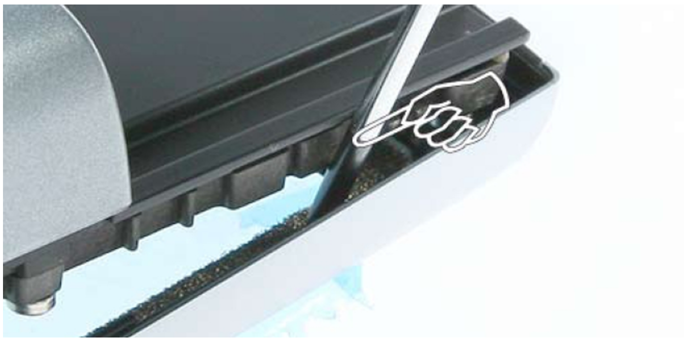
8. After releasing both clips shift out the unit.



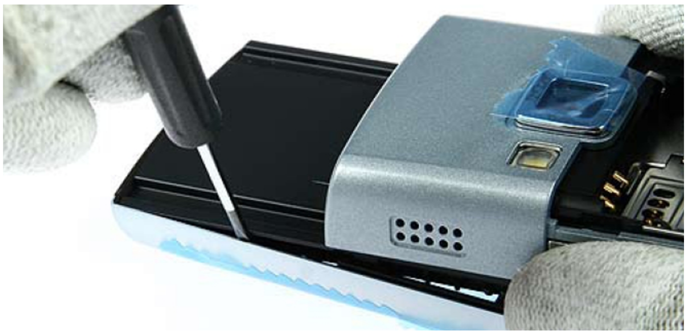
9. Now lift the lower side and keep it in this position.



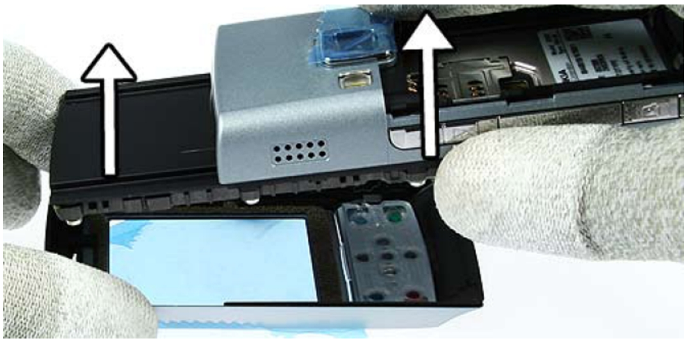
10. Carefully release the upper clips of the **A-Cover** with a slotted screwdriver.



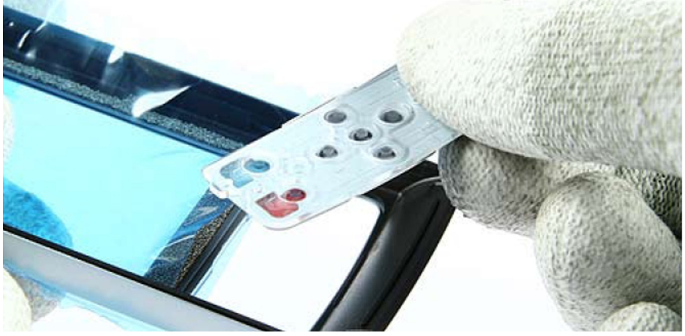
11. Release the clips on the opposite side too.



12. The separation of the parts becomes easy if all clips are correctly released.

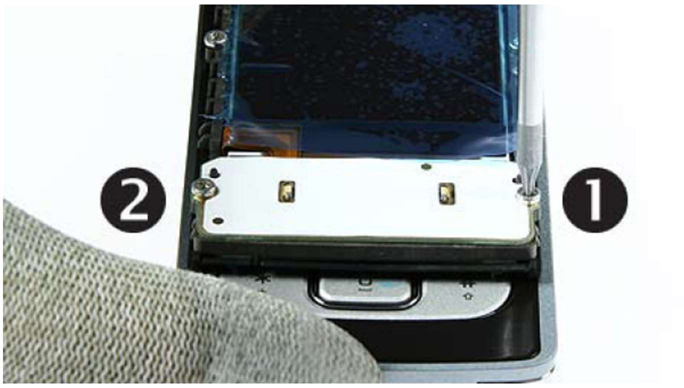


13. Protect the innerside of the window with a plastic film and seperate the **Function Keymat**.

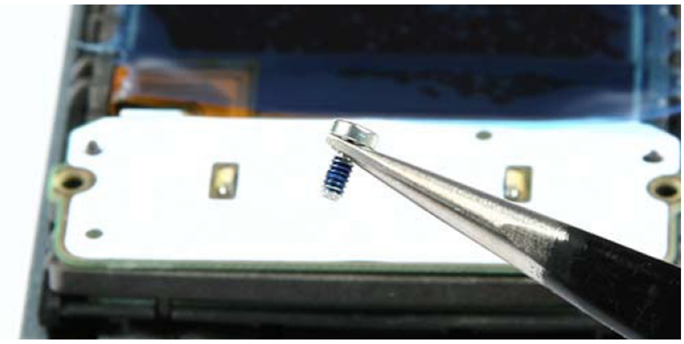


14. Protect the **LCD** with a plastic film too.

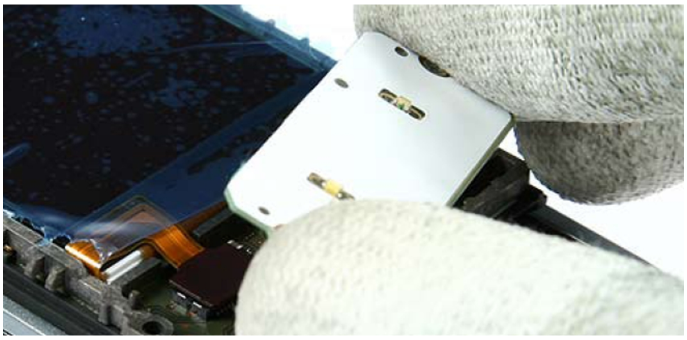
15. Remove 2 Torx size 6 screws in the shown order. **For assembly use the reverse order and a torque of 14 Ncm.**



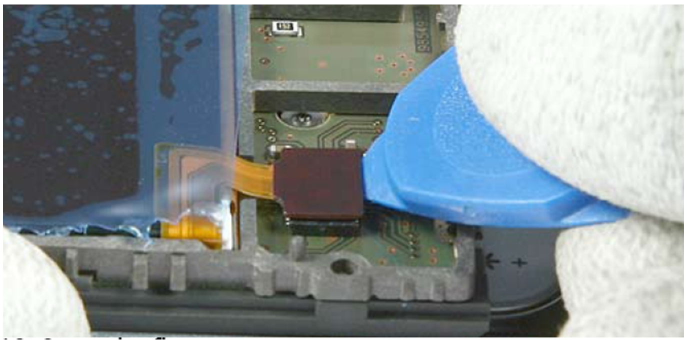
16. All screws in this phone must be renewed after removal.



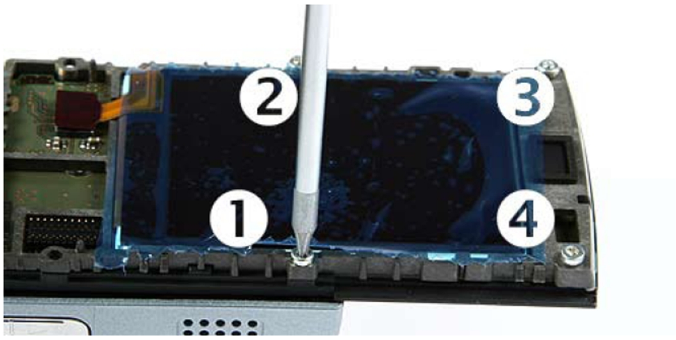
17. Remove the **UI PWB**.



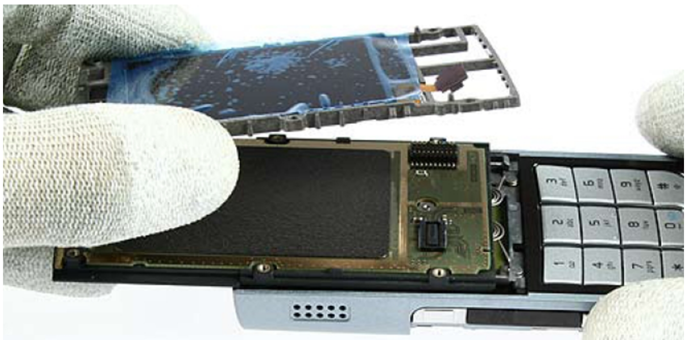
18. Open the flex connector.



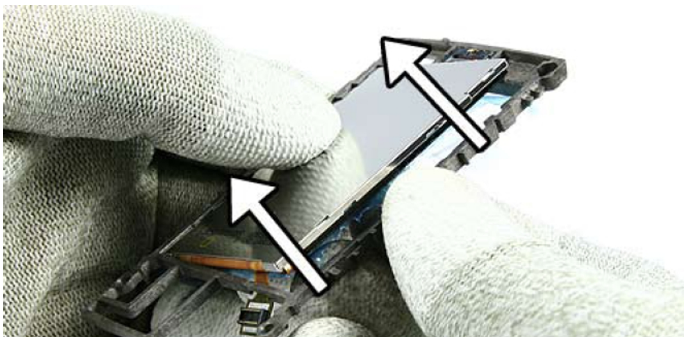
19. Remove 4 Torx size 6 screws in the shown order. **For assembly use the reverse order and the torque of 14 Ncm.**



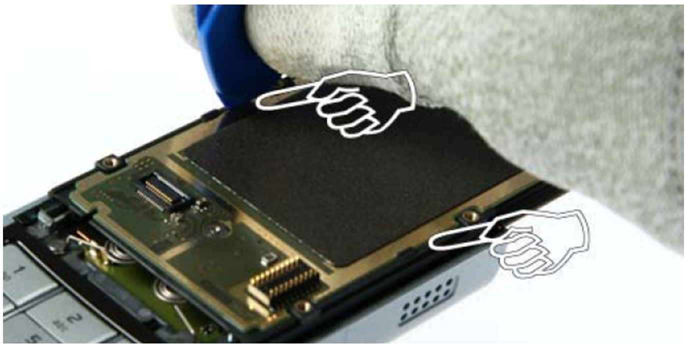
20. Remove the **LCD Frame Assy**.



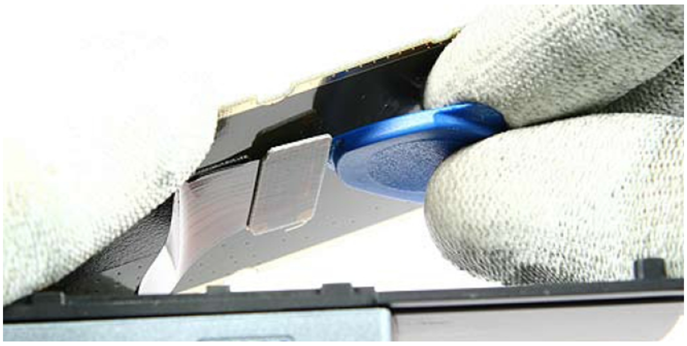
21. Separate the **LCD** from the **Frame**.



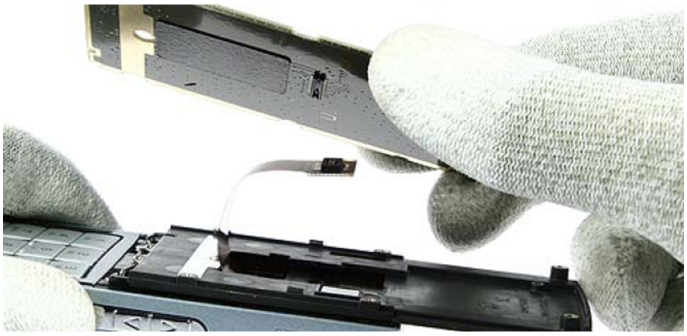
22. Release the Clips and lift out the **Upper PWB Assy**. Bear in mind that the **PWB** is still connected with a flex foil.



23. Carefully open the **Main Flex Connector**.



24. Remove the **Upper PWB**.



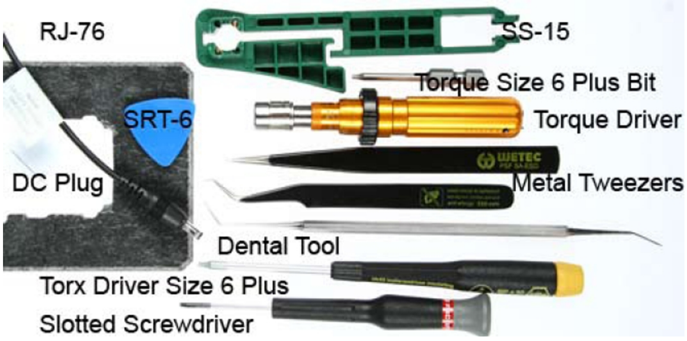
Disassembly instructions (lower part)

Before you begin

- Reassembly takes place in the reverse order.

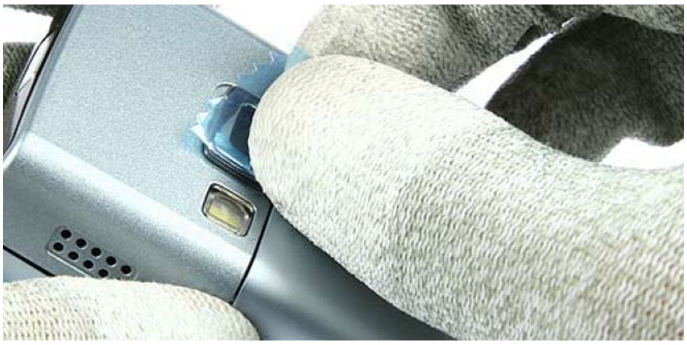
Steps

1. Use these tools for disassembly and reassembly.

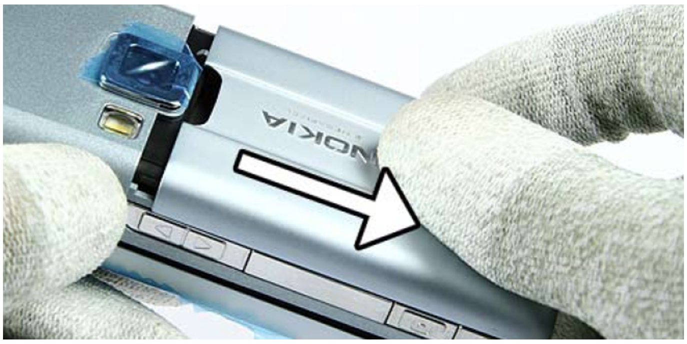

RJ-76
SS-15
Torque Size 6 Plus Bit
SRT-6
Torque Driver
DC Plug
Metal Tweezers
Dental Tool
Torx Driver Size 6 Plus
Slotted Screwdriver

2. Protect the window with a plastic film.

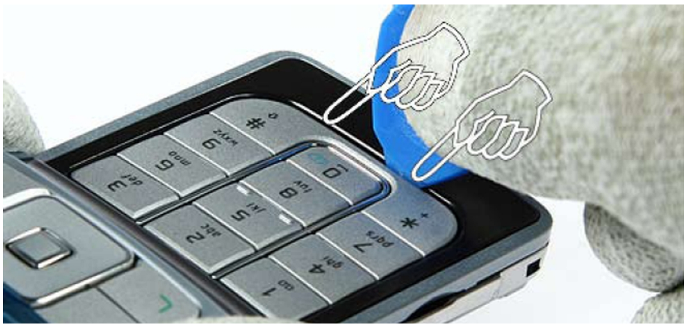
3. Protect the camera window too.



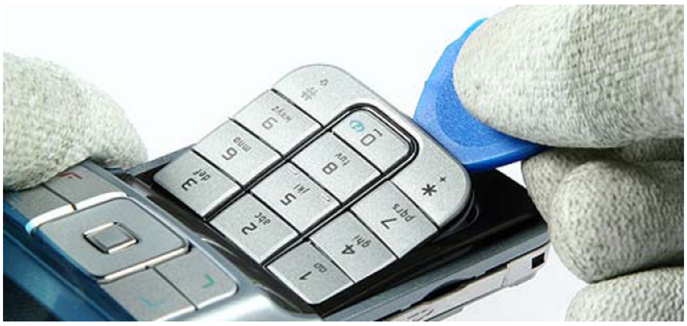
4. Remove the **Battery Cover**. Ensure that no battery is still inserted.



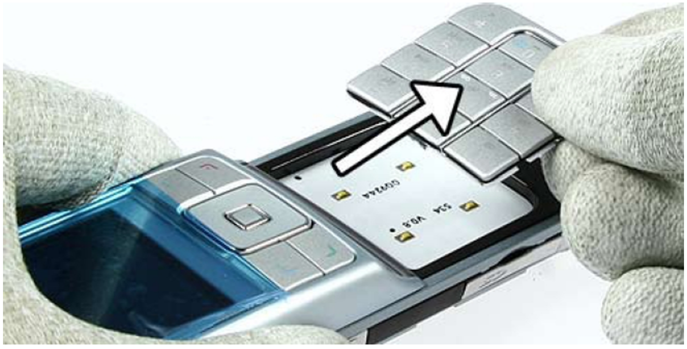
5. Release the clips of the **Keymat** with the SRT-6 as shown.



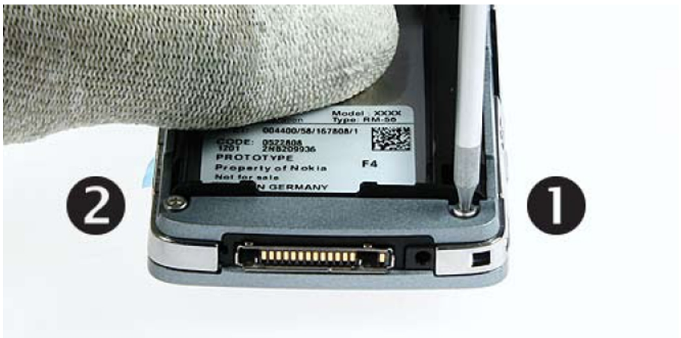
6. Ensure that all clips are released.



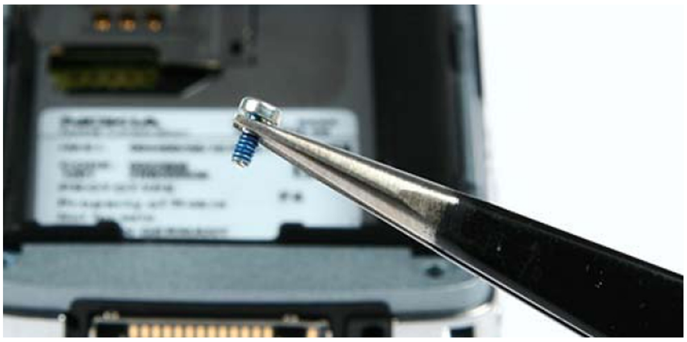
7. Separate the **Keypad**.



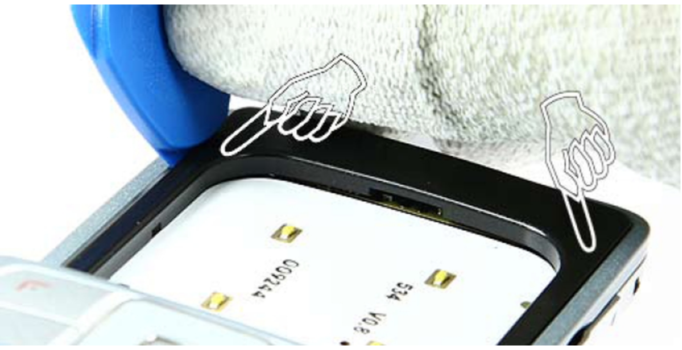
8. Remove the 2 torx size 6 screws in the shown order. **For assembly use the reverse order and a torque of 14 Ncm**.



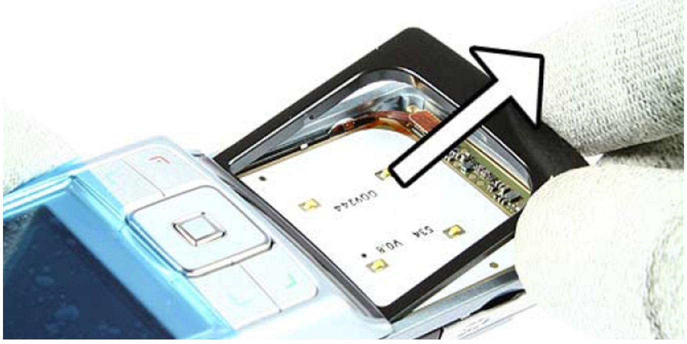
9. Note that all screws used in this phone must be renewed after removal.



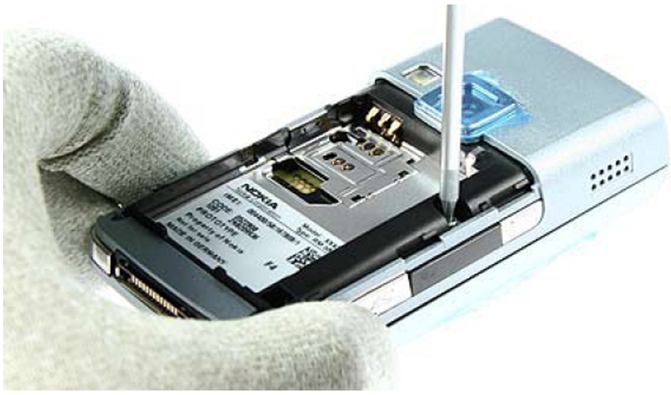
10. Release the plastic clips of the **Keymat Cover Assy**.



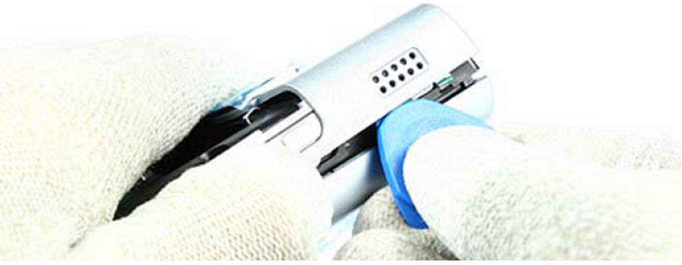
11. After releasing the clips, the **Keymat Cover Assy** can be removed easily.



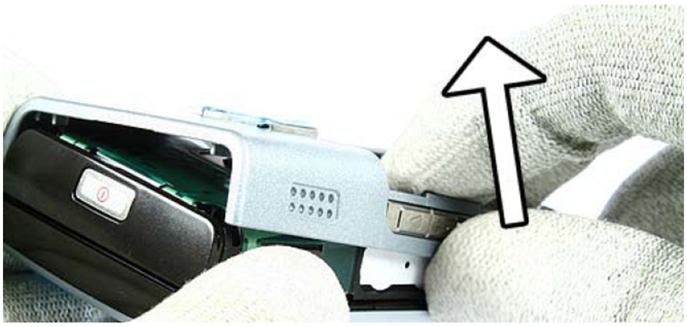
12. Remove the screw. **For assembly use a torque of 14 Ncm**.



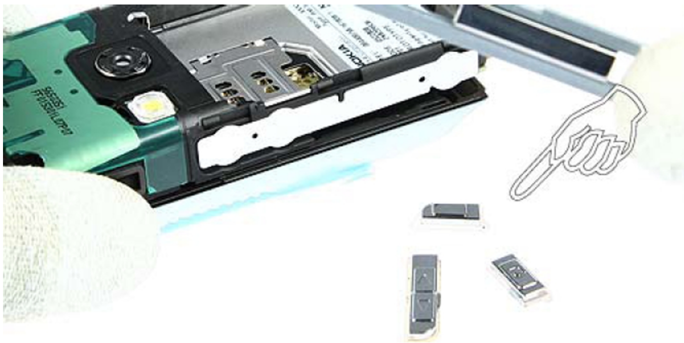
13. Release the clips of the **Back Cover Assy** on both sides as shown.



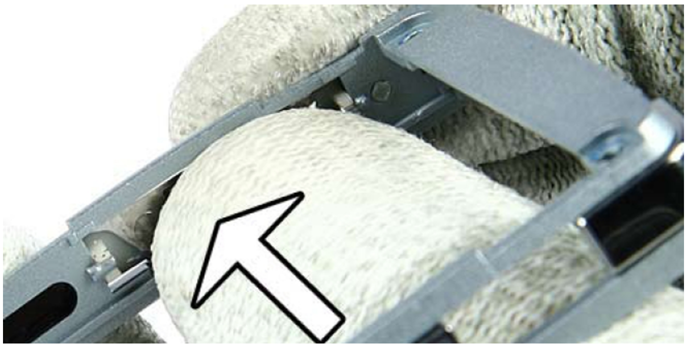
14. Lift the **Back Cover Assy** from one side first carefully.



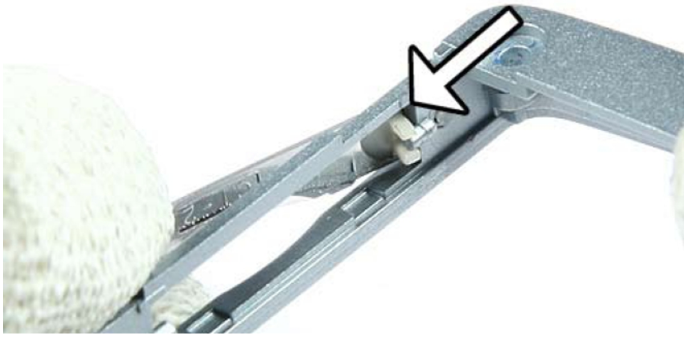
15. The keys are not fixed anymore. Do not loose them.



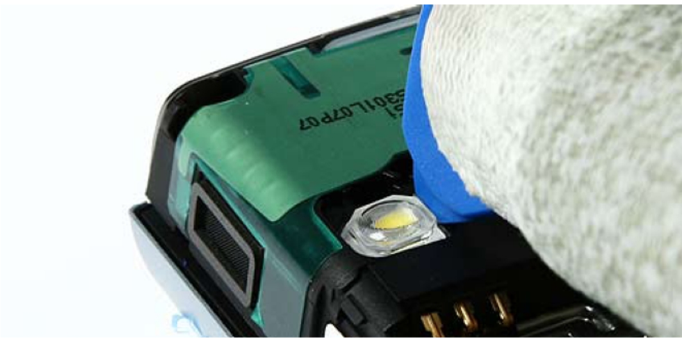
16. Carefully push out the hinge of the **SD Door** from the shown side first.



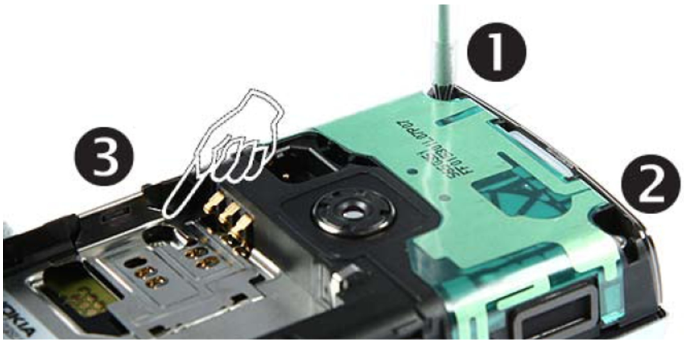
17. Now pull out the other side.



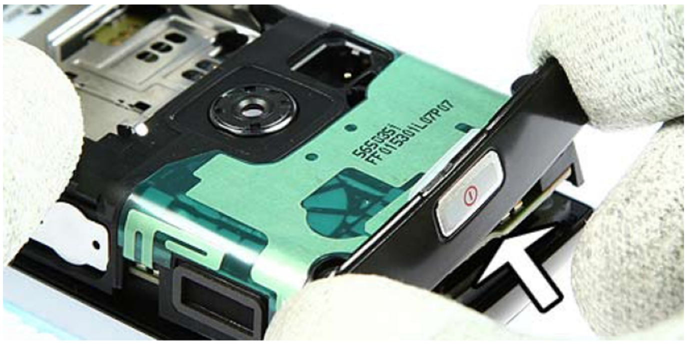
18. Release the **Flash Light** with the SRT-6.



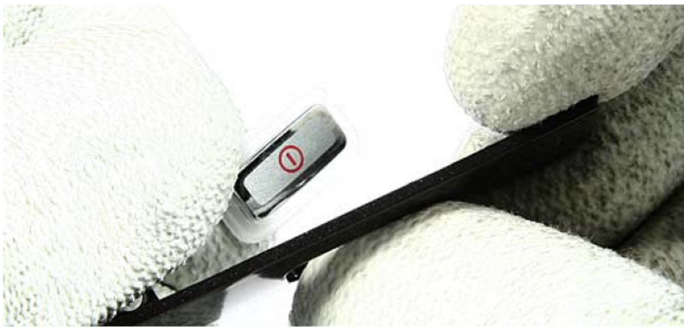
19. Remove the 3 screws in the shown order. **For assembly use the reverse order and a torque of 14 Ncm**.



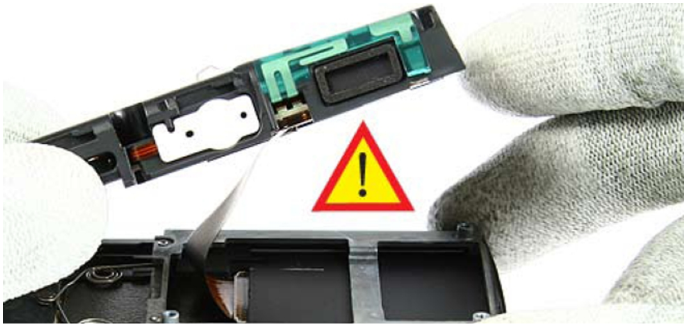
20. Remove the **Top Cover Assy**.



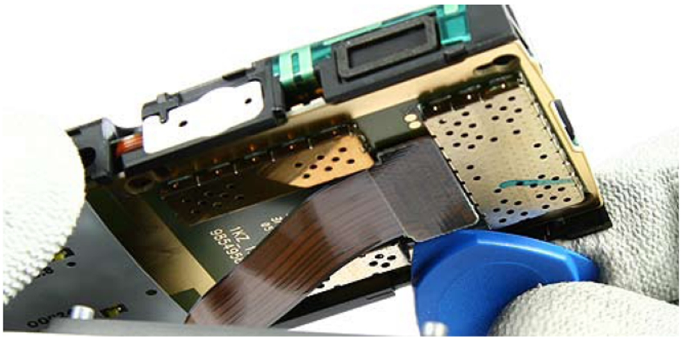
21. Push out the **Power Button**.



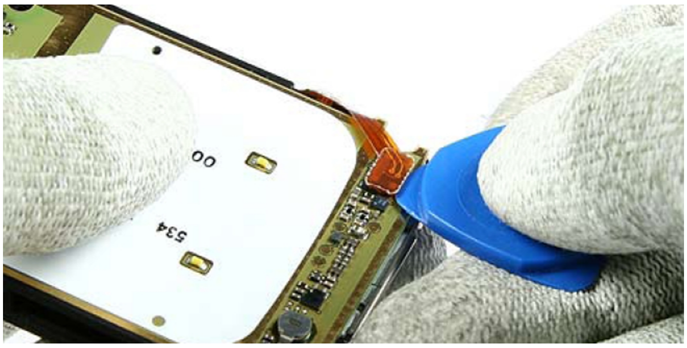
22. Lift out the **Engine Module**. Bear in mind that the **Main Flex** is still connected.



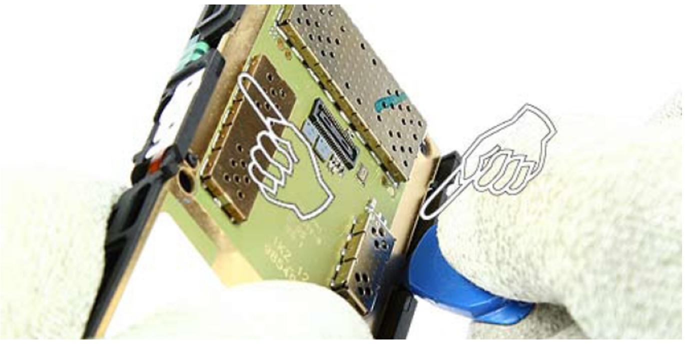
23. Open the connector of the **Main Flex**.



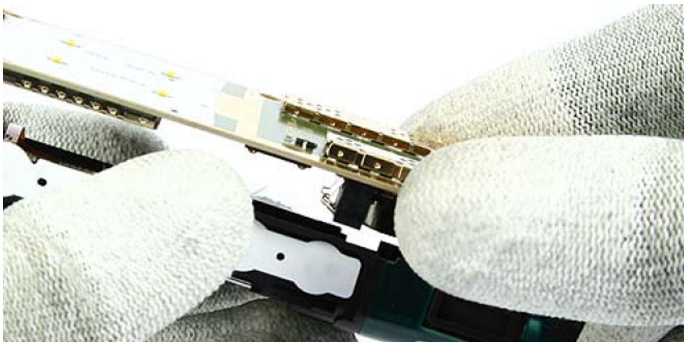
24. Open the connector of the **Side Key Flex Assy**.



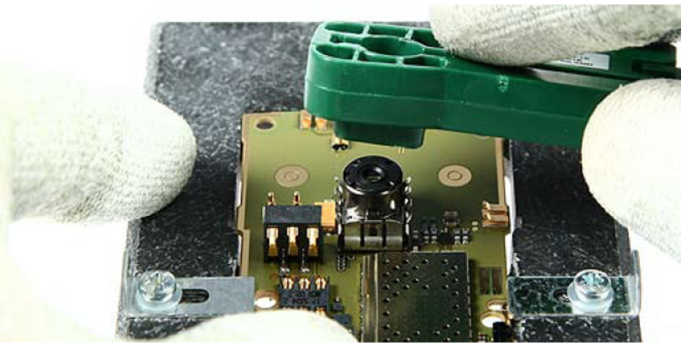
25. Release the plastic clips as shown.



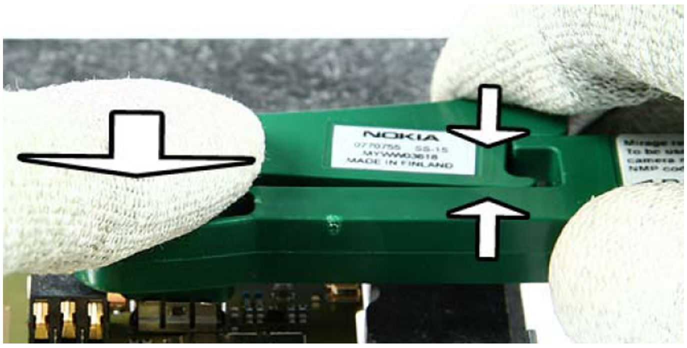
26. Lift out the **Engine Module** and place it into the rework jig.



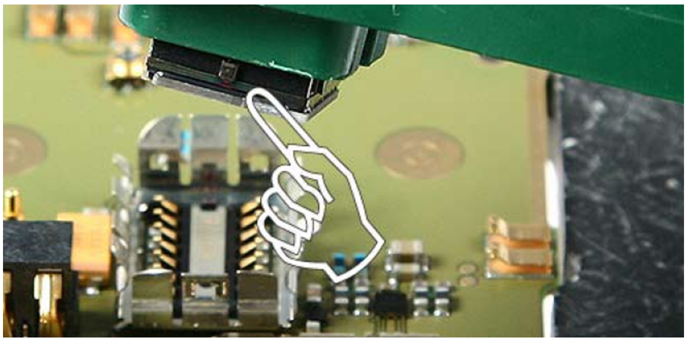
27. Use the SS-15 camera removal tool to remove the **Camera**.



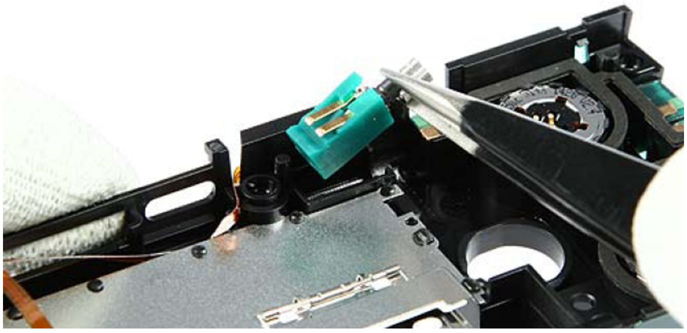
28. Place the tool and push it down carefully. Fix the **Camera**.



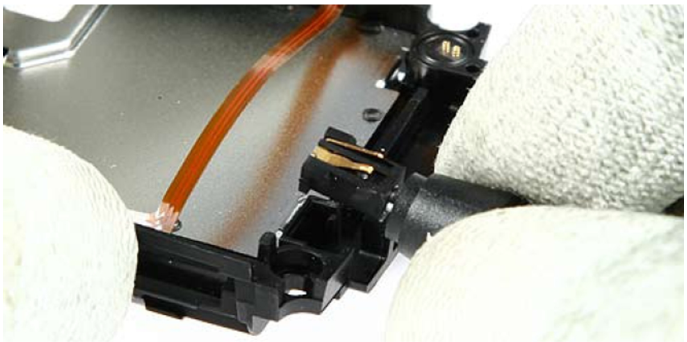
29. Now pull the **Camera** upwards. **For assembly mind the correct position and use the assembly side of the SS-15**.



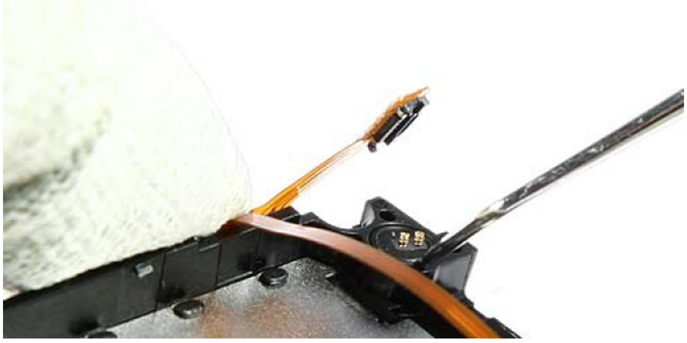
30. Lever out the **Vibra**.



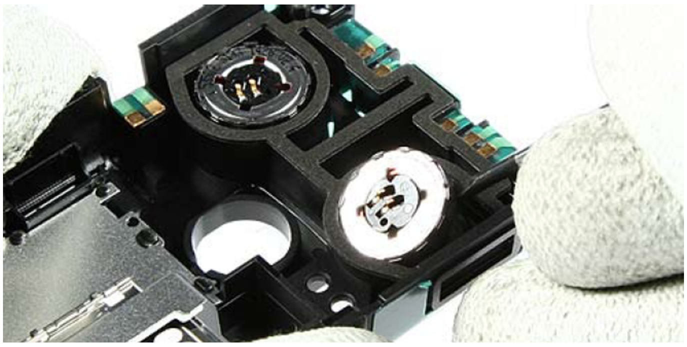
31. Remove the **DC Jack** with the **DC plug**.



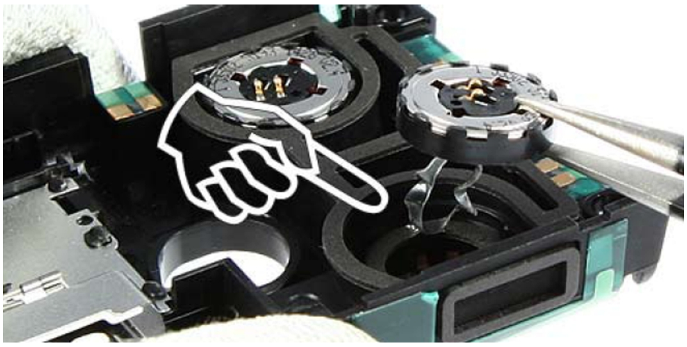
32. Remove the **Microphone** with the dental tool.



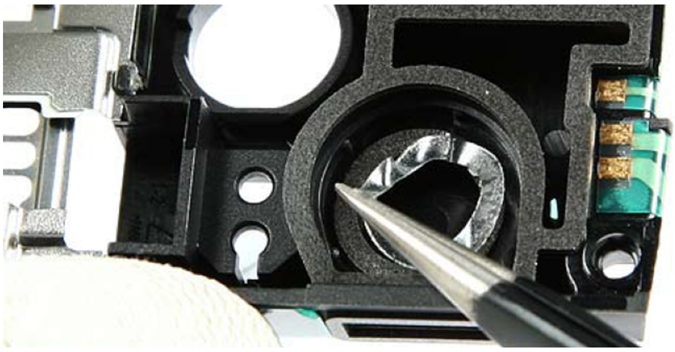
33. Lever out both **IHF Speakers**.



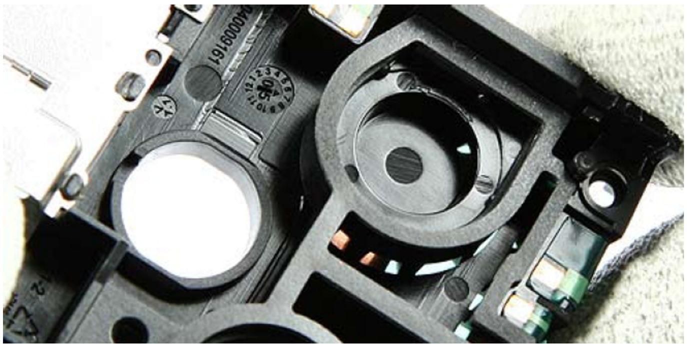
34. The **IHF Speaker Adhesives** will be destroyed surely. **Always use new ones when reassemble**.



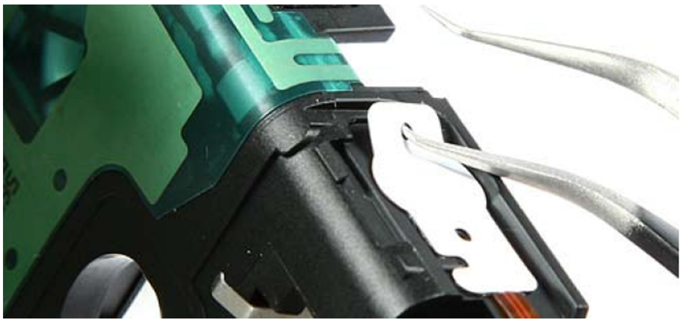
35. Peel up the **Adhesive residues** with tweezers.



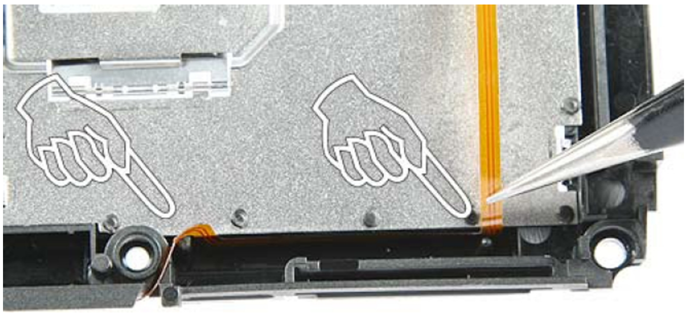
36. Ensure that no residues remain when replacing the **IHF Speakers**.



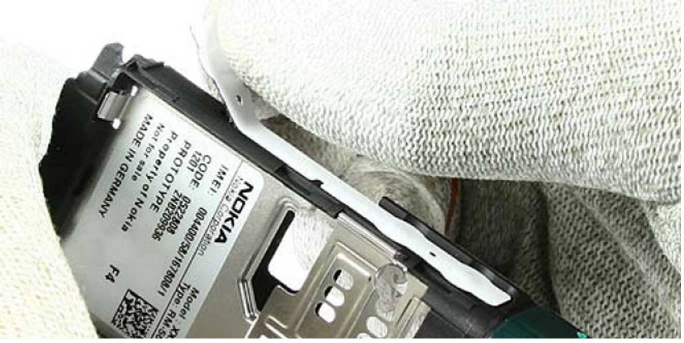
37. Peel up the **Side Key Flex Assy** with angled tweezers at the shown side first.



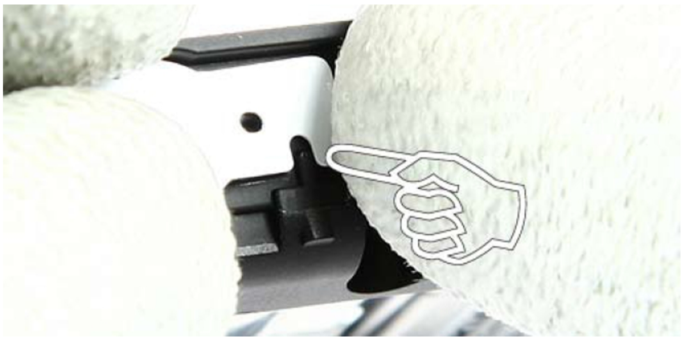
38. **For Assembly note the guiding while placing a new Side Key Flex Assy**.



39. Continue with the larger part. Peel it up slowly to prevent adhesive residues.


NOKIA
PROTOTYPE
Property of Nokia
Not for sale
MADE IN GERMANY
F4

40. For Assembly mind the correct positioning of the **Side Key Flex Assy**.



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6 — BB Troubleshooting and Manual Tuning Guide

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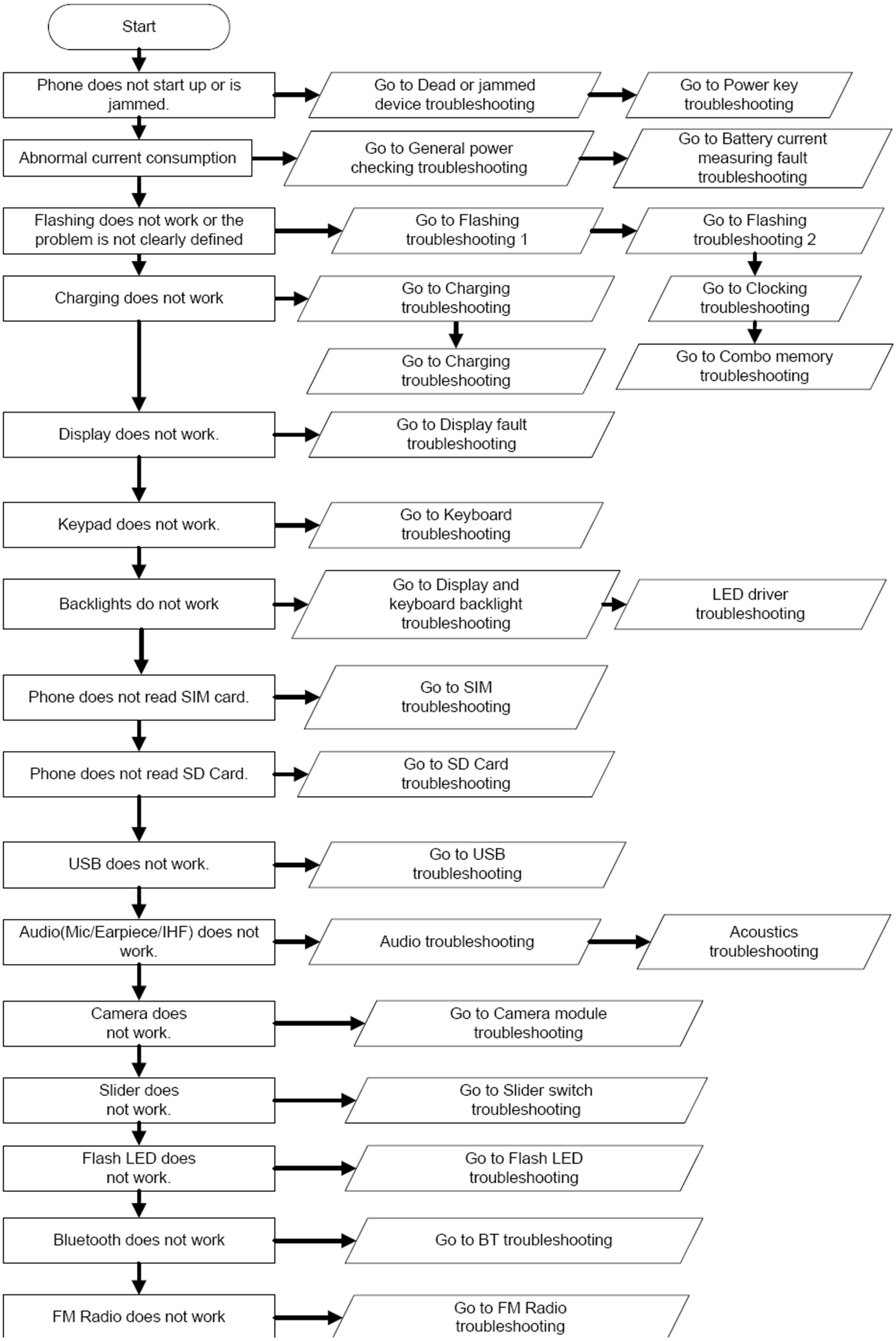
Baseband troubleshooting

Context

This section is intended to be a guide for localising and repairing electrical faults. The fault repairing is divided into troubleshooting paths.

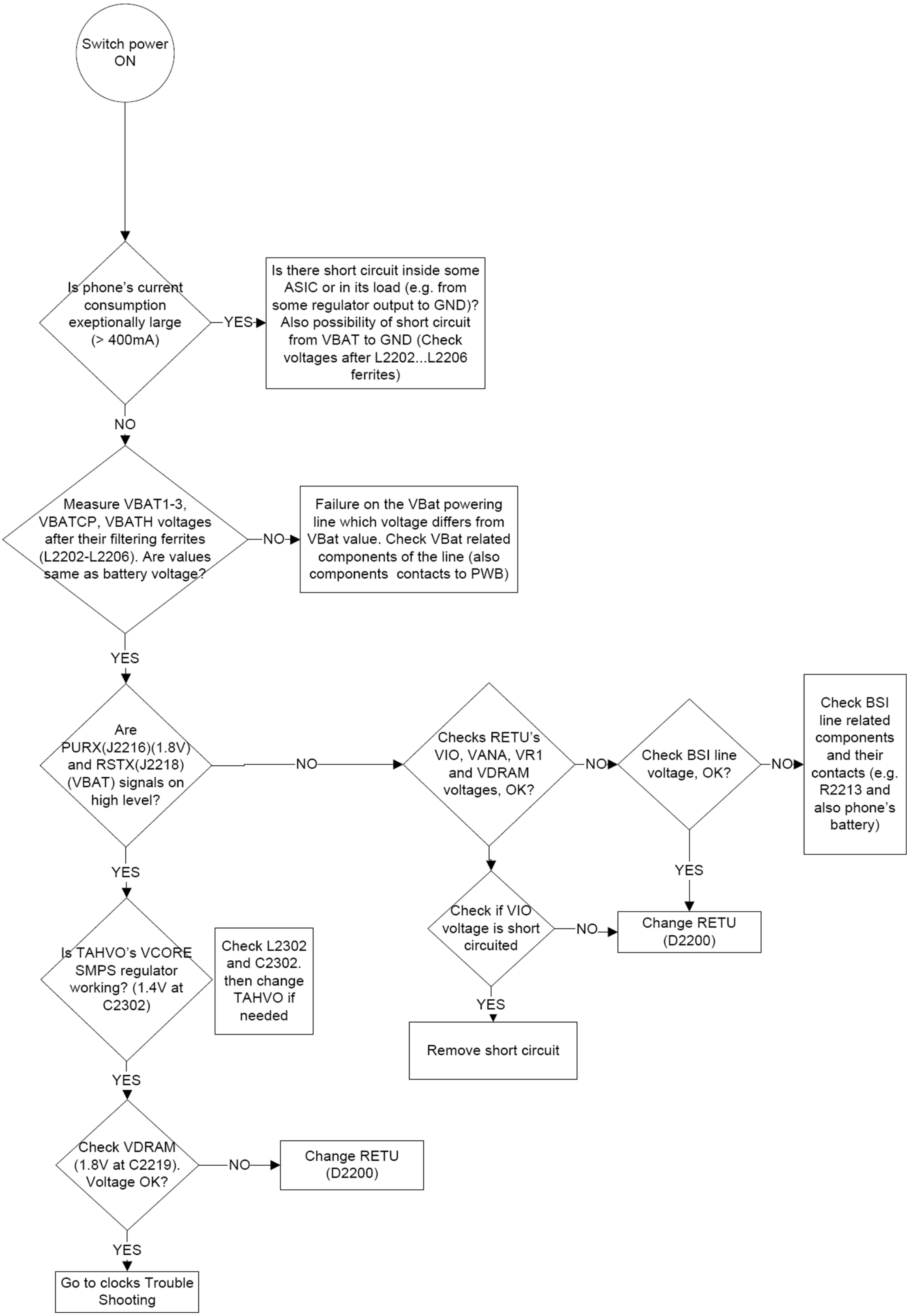
The following main troubleshooting tree describes the different baseband troubleshooting paths to be followed in fault situations.

Troubleshooting flow


Start
Phone does not start up or is jammed.
Go to Dead or jammed device troubleshooting
Go to Power key troubleshooting
Abnormal current consumption
Go to General power checking troubleshooting
Go to Battery current measuring fault troubleshooting
Flashing does not work or the problem is not clearly defined
Go to Flashing troubleshooting 1
Go to Flashing troubleshooting 2
Go to Clocking troubleshooting
Go to Combo memory troubleshooting
Charging does not work
Go to Charging troubleshooting
Go to Charging troubleshooting
Display does not work.
Go to Display fault troubleshooting
Keypad does not work.
Go to Keyboard troubleshooting
Backlights do not work
Go to Display and keyboard backlight troubleshooting
LED driver troubleshooting
Phone does not read SIM card.
Go to SIM troubleshooting
Phone does not read SD Card.
Go to SD Card troubleshooting
USB does not work.
Go to USB troubleshooting
Audio(Mic/Earpiece/IHF) does not work.
Audio troubleshooting
Acoustics troubleshooting
Camera does not work.
Go to Camera module troubleshooting
Slider does not work.
Go to Slider switch troubleshooting
Flash LED does not work.
Go to Flash LED troubleshooting
Bluetooth does not work
Go to BT troubleshooting
FM Radio does not work
Go to FM Radio troubleshooting

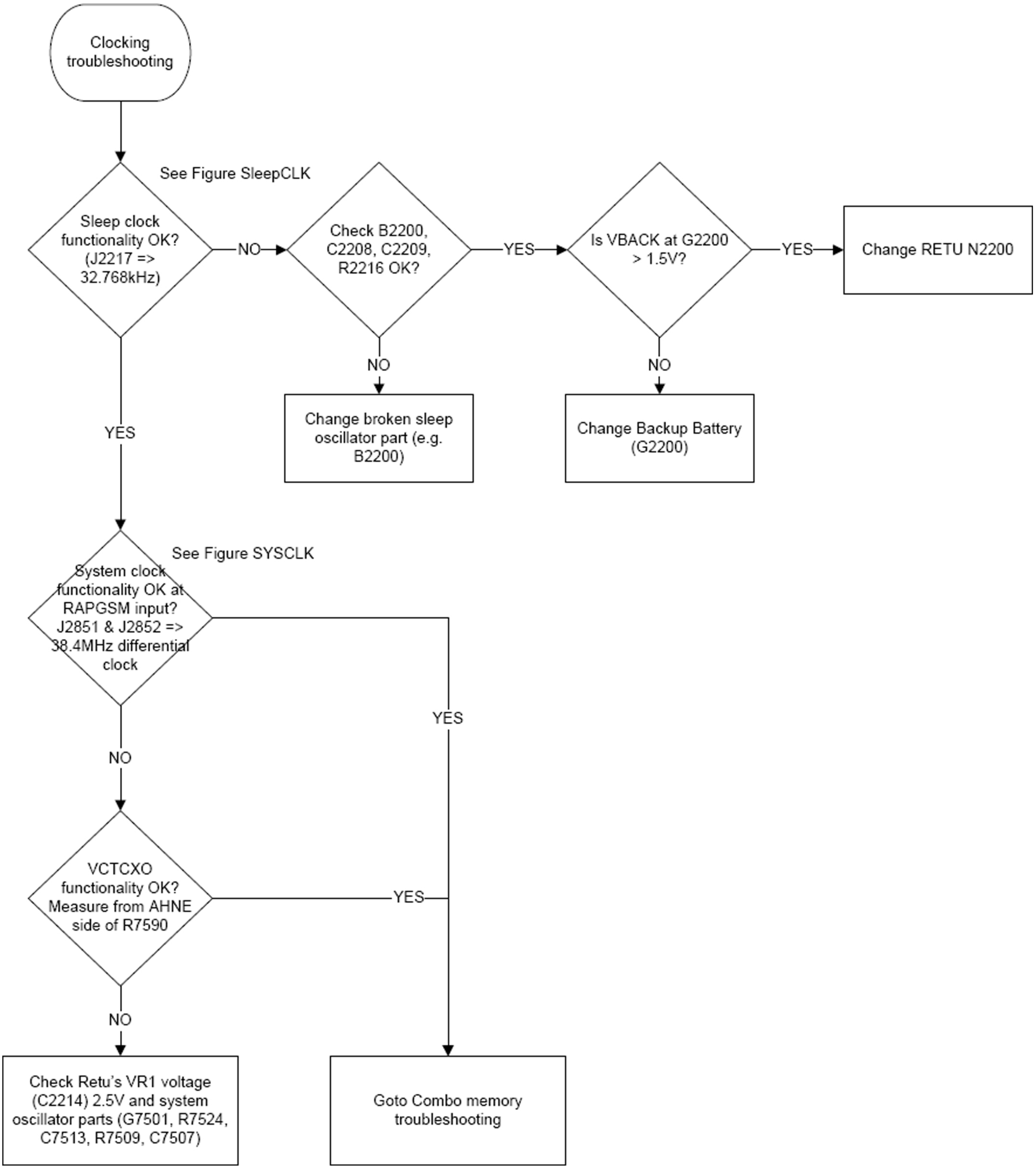
General power checking troubleshooting

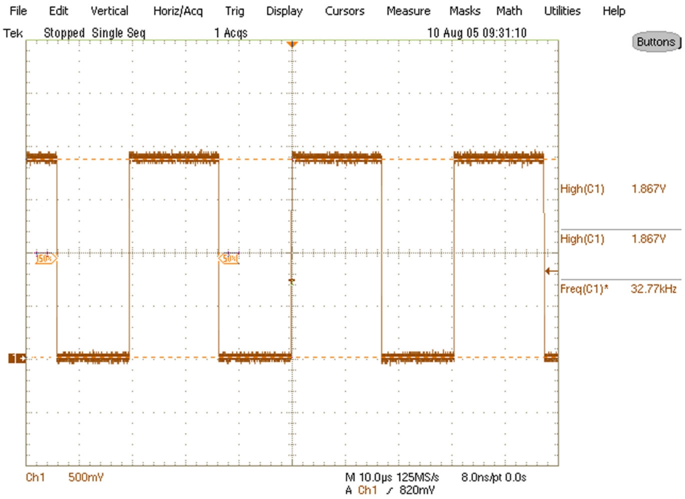
Troubleshooting flow


Switch power ON
Is phone's current consumption exceptionally large (> 400mA)
YES
Is there short circuit inside some ASIC or in its load (e.g. from some regulator output to GND)? Also possibility of short circuit from VBAT to GND (Check voltages after L2202...L2206 ferrites)
NO
Measure VBAT1-3, VBATCP, VBATH voltages after their filtering ferrites (L2202-L2206). Are values same as battery voltage?
NO
Failure on the VBat powering line which voltage differs from VBat value. Check VBat related components of the line (also components contacts to PWB)
YES
Are PURX(J2216)(1.8V) and RSTX(J2218) (VBAT) signals on high level?
NO
Checks RETU's VIO, VANA, VR1 and VDRAM voltages, OK?
NO
Check BSI line voltage, OK?
NO
Check BSI line related components and their contacts (e.g. R2213 and also phone's battery)
YES
Change RETU (D2200)
Check if VIO voltage is short circuited
NO
YES
Remove short circuit
YES
Is TAHVO's VCORE SMPS regulator working? (1.4V at C2302)
Check L2302 and C2302. then change TAHVO if needed
YES
Check VDRAM (1.8V at C2219). Voltage OK?
NO
Change RETU (D2200)
YES
Go to clocks Trouble Shooting

Clocking troubleshooting

Troubleshooting flow


Clocking troubleshooting
See Figure SleepCLK
Sleep clock functionality OK? (J2217 => 32.768kHz)
NO
Check B2200, C2208, C2209, R2216 OK?
YES
Is VBACK at G2200 > 1.5V?
YES
Change RETU N2200
NO
Change broken sleep oscillator part (e.g. B2200)
NO
Change Backup Battery (G2200)
YES
See Figure SYSCLK
System clock functionality OK at RAPGSM input? J2851 & J2852 => 38.4MHz differential clock
YES
NO
VCTCXO functionality OK? Measure from AHNE side of R7590
YES
NO
Check Retu's VR1 voltage (C2214) 2.5V and system oscillator parts (G7501, R7524, C7513, R7509, C7507)
Goto Combo memory troubleshooting

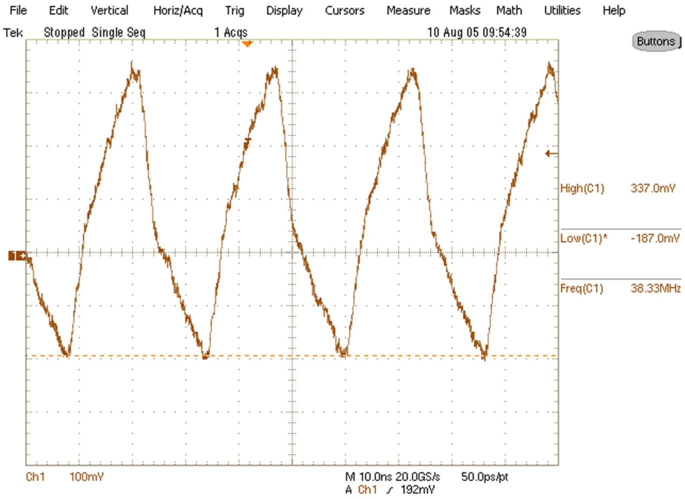

File
Edit
Vertical
Horiz/Acq
Trig
Display
Cursors
Measure
Masks
Math
Utilities
Help
Buttons

Tek Stopped Single Seq 1 Acqs 10 Aug 05 09:31:10

High(C1) 1.867V
High(C1) 1.867V
Freq(C1)* 32.77kHz

Ch1 500mV M 10.0µs 125MS/s 8.0ns/pt 0.0s
A Ch1 ⁄ 820mV

Figure 36 SleepCLK


File
Edit
Vertical
Horiz/Acq
Trig
Display
Cursors
Measure
Masks
Math
Utilities
Help
Buttons

Tek Stopped Single Seq 1 Acqs 10 Aug 05 09:54:39

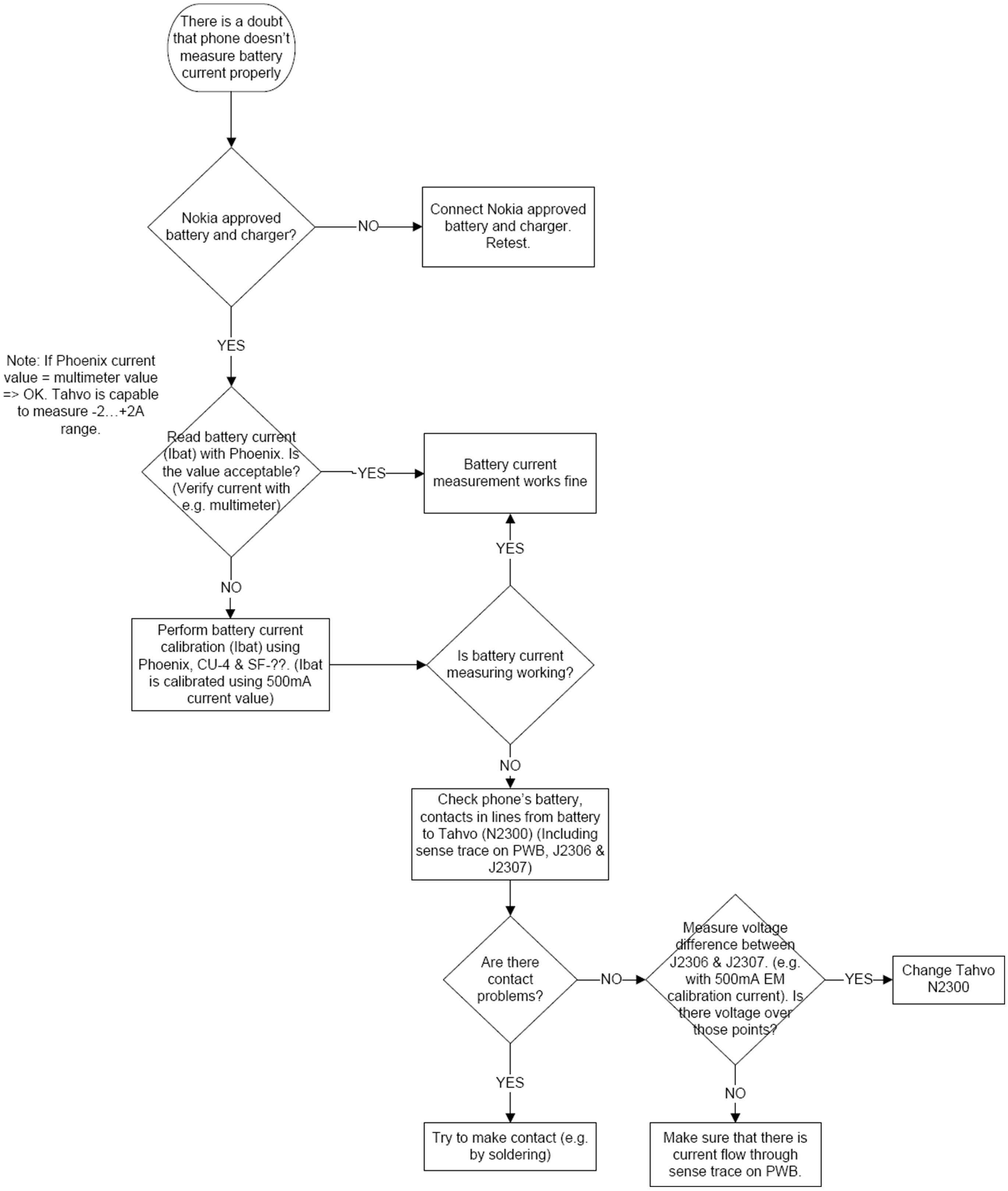
High(C1) 337.0mV
Low(C1)* -187.0mV
Freq(C1) 38.33MHz

Ch1 100mV M 10.0ns 20.0GS/s 50.0ps/pt
A Ch1 ⁄ 192mV

Figure 37 SYSCLK

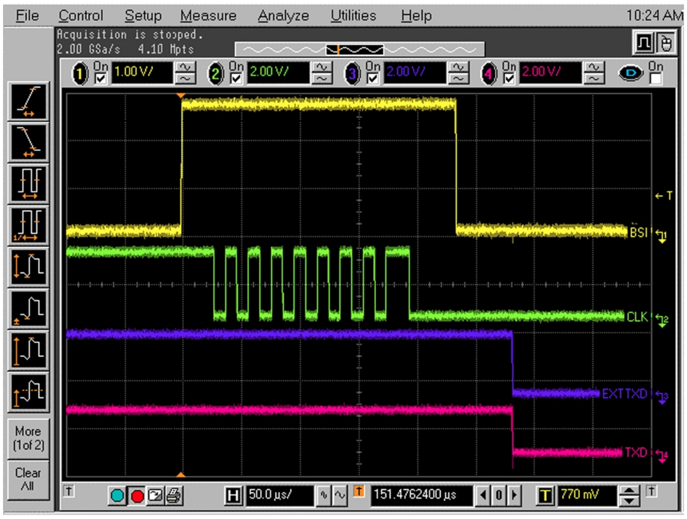
Battery current measuring fault troubleshooting

Troubleshooting flow


There is a doubt that phone doesn't measure battery current properly
Nokia approved battery and charger?
NO
Connect Nokia approved battery and charger. Retest.
YES
Note: If Phoenix current value = multimeter value => OK. Tahvo is capable to measure -2…+2A range.
Read battery current (Ibat) with Phoenix. Is the value acceptable? (Verify current with e.g. multimeter)
YES
Battery current measurement works fine
NO
Perform battery current calibration (Ibat) using Phoenix, CU-4 & SF-??. (Ibat is calibrated using 500mA current value)
YES
Is battery current measuring working?
NO
Check phone's battery, contacts in lines from battery to Tahvo (N2300) (Including sense trace on PWB, J2306 & J2307)
Are there contact problems?
NO
Measure voltage difference between J2306 & J2307. (e.g. with 500mA EM calibration current). Is there voltage over those points?
YES
Change Tahvo N2300
YES
Try to make contact (e.g. by soldering)
NO
Make sure that there is current flow through sense trace on PWB.

Flash programming fault troubleshooting

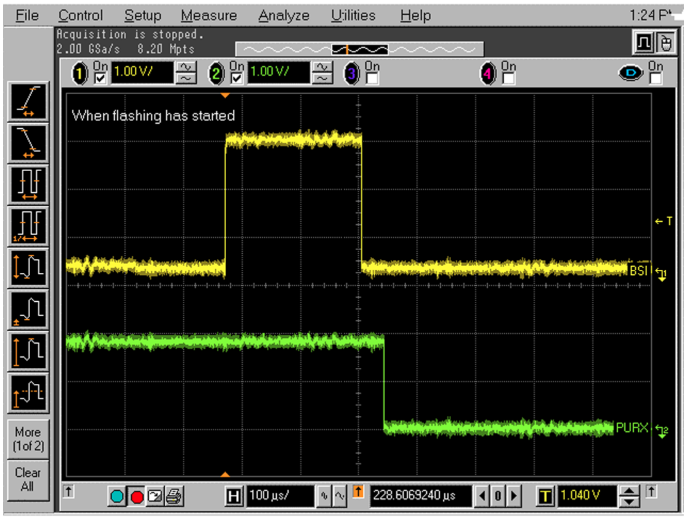
Troubleshooting flow


Acquisition is stopped.
2.00 GSa/s 4.10 Mpts

File
Control
Setup
Measure
Analyze
Utilities
Help
10:24 AM
1.00 V/
2.00 V/
2.00 V/
2.00 V/
BSI
CLK
EXTTXD
TXD
More (1of 2)
Clear All
50.0 µs/
151.4762400 µs
770 mV

Figure 38 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.

Saved: 05 JUL 2004 13:24:19


Acquisition is stopped.
2.00 GSa/s 8.20 Mpts

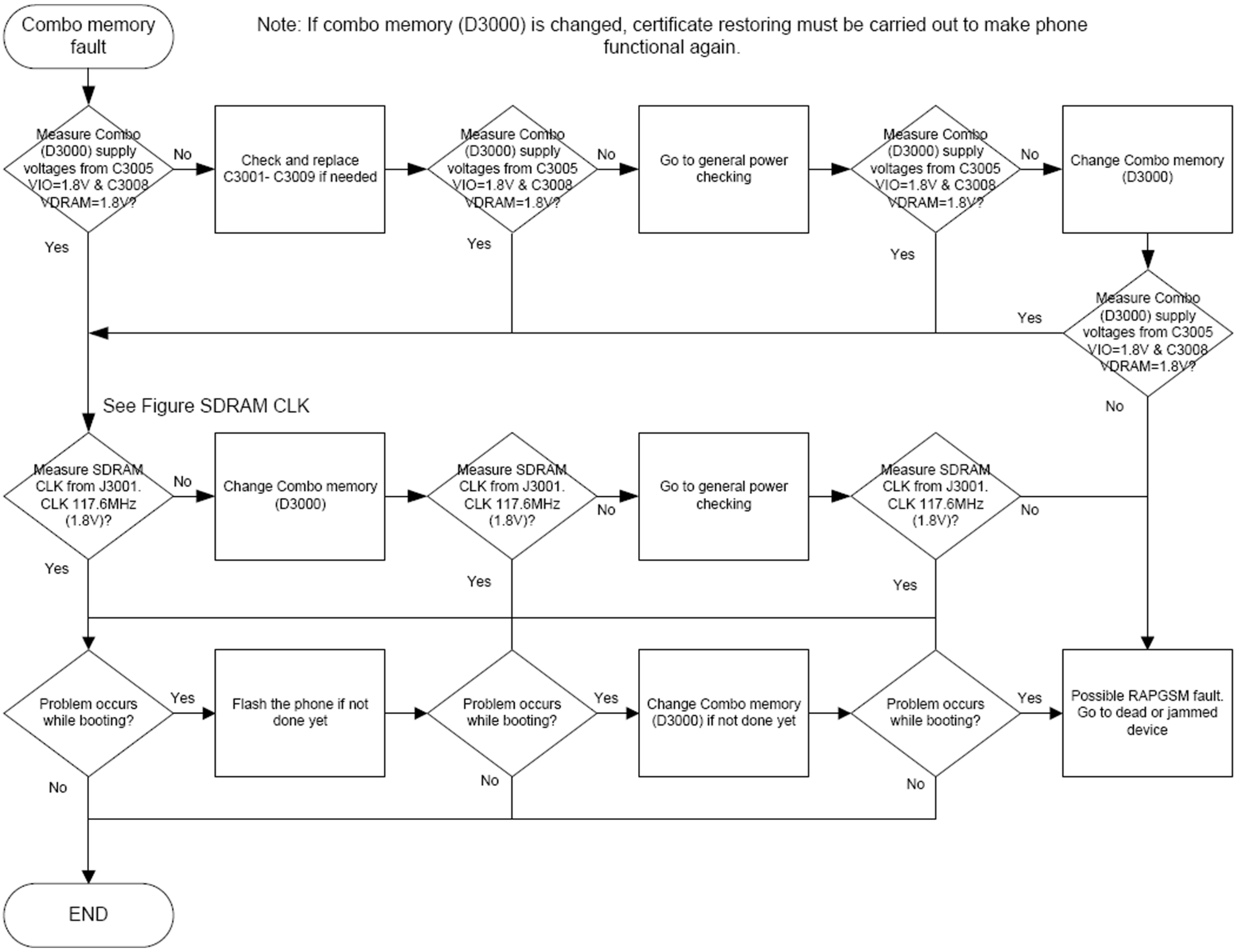
When flashing has started

File
Control
Setup
Measure
Analyze
Utilities
Help
1:24 PM
1.00 V/
1.00 V/
BSI
PURX
More (1of 2)
Clear All
100 µs/
228.6069240 µs
1.040 V

Figure 39 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.

COMBO memory troubleshooting

Troubleshooting flow


Combo memory fault
Note: If combo memory (D3000) is changed, certificate restoring must be carried out to make phone functional again.
Measure Combo (D3000) supply voltages from C3005 VIO=1.8V & C3008 VDRAM=1.8V?
No
Check and replace C3001- C3009 if needed
Measure Combo (D3000) supply voltages from C3005 VIO=1.8V & C3008 VDRAM=1.8V?
No
Go to general power checking
Measure Combo (D3000) supply voltages from C3005 VIO=1.8V & C3008 VDRAM=1.8V?
No
Change Combo memory (D3000)
Yes
Yes
Yes
Measure Combo (D3000) supply voltages from C3005 VIO=1.8V & C3008 VDRAM=1.8V?
Yes
No
See Figure SDRAM CLK
Measure SDRAM CLK from J3001. CLK 117.6MHz (1.8V)?
No
Change Combo memory (D3000)
Measure SDRAM CLK from J3001. CLK 117.6MHz (1.8V)?
No
Go to general power checking
Measure SDRAM CLK from J3001. CLK 117.6MHz (1.8V)?
No
Yes
Yes
Yes
Problem occurs while booting?
Yes
Flash the phone if not done yet
Problem occurs while booting?
Yes
Change Combo memory (D3000) if not done yet
Problem occurs while booting?
Yes
Possible RAPGSM fault. Go to dead or jammed device
No
No
No
END

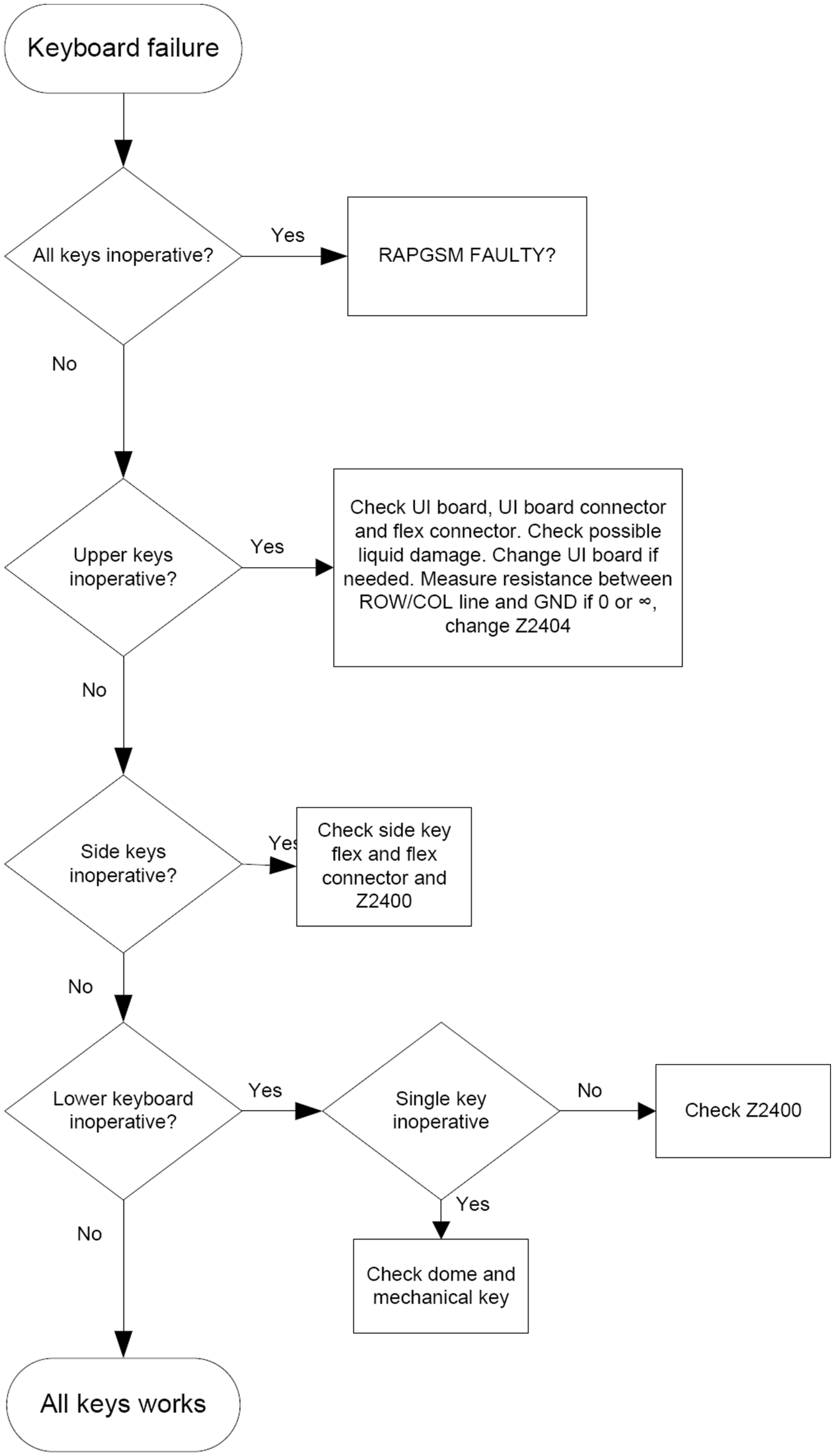
Keyboard troubleshooting

Context

There are two possible failure modes in the keyboard module: a) One or more keys can be stuck, so that the key does not react when a keydome is pressed. This kind of failure is caused by mechanical reasons (dirt, rust), b) Malfunction of several keys at the same time; this happens when one or more rows or columns are failing (shortcut or open connection).

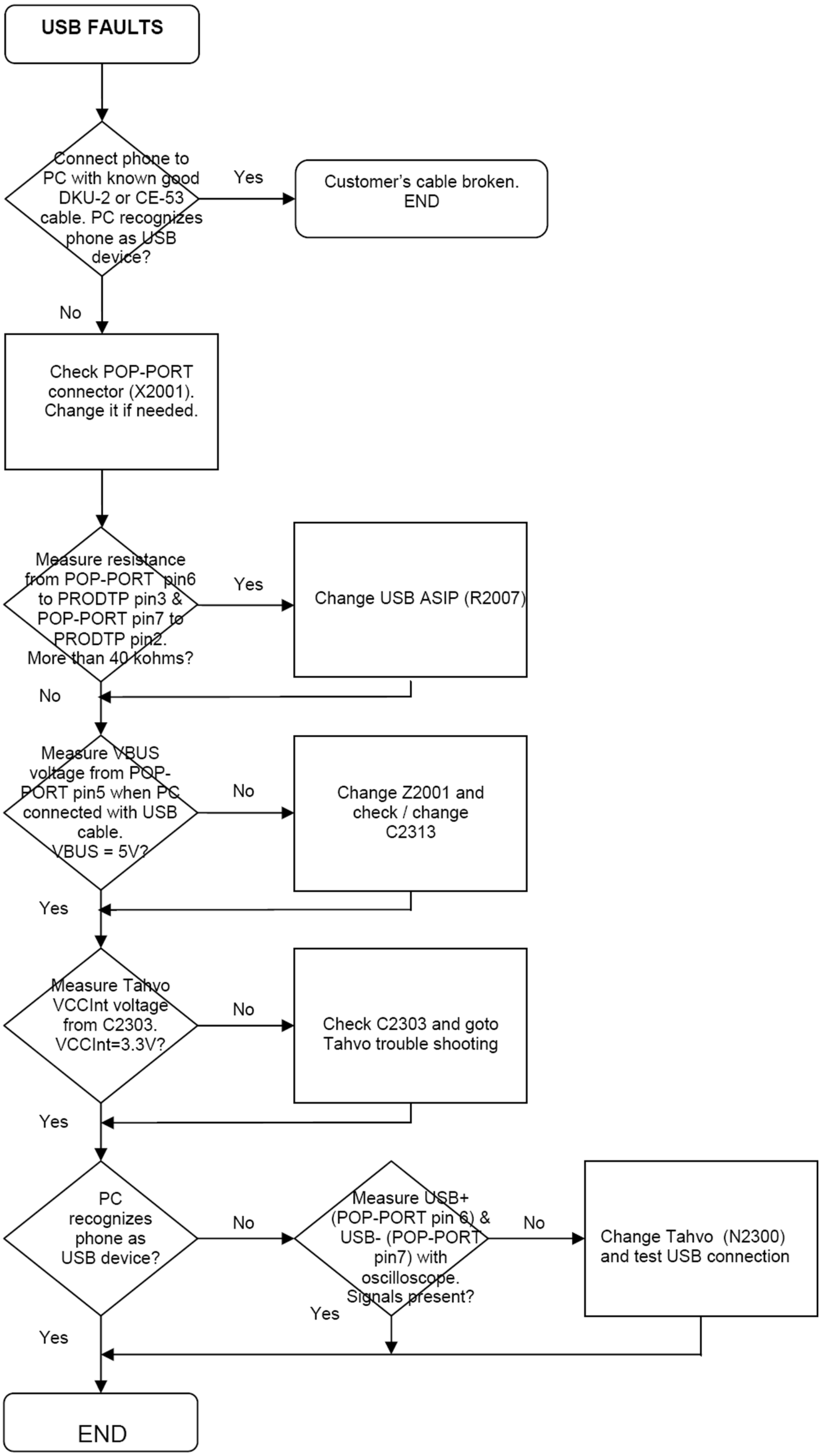
For a more detailed description of the keyboard and keymatrix, see section Keyboard. If the failure mode is not clear, start with the Keyboard Test in Phoenix.

Troubleshooting flow


Keyboard failure
All keys inoperative?
Yes
RAPGSM FAULTY?
No
Upper keys inoperative?
Yes
Check UI board, UI board connector and flex connector. Check possible liquid damage. Change UI board if needed. Measure resistance between ROW/COL line and GND if 0 or ∞, change Z2404
No
Side keys inoperative?
Yes
Check side key flex and flex connector and Z2400
No
Lower keyboard inoperative?
Yes
Single key inoperative
No
Check Z2400
Yes
Check dome and mechanical key
No
All keys works

USB troubleshooting

Troubleshooting flow


USB FAULTS
Connect phone to PC with known good DKU-2 or CE-53 cable. PC recognizes phone as USB device?
Yes
Customer's cable broken. END
No
Check POP-PORT connector (X2001). Change it if needed.
Measure resistance from POP-PORT pin6 to PRODTP pin3 & POP-PORT pin7 to PRODTP pin2. More than 40 kohms?
Yes
Change USB ASIP (R2007)
No
Measure VBUS voltage from POP-PORT pin5 when PC connected with USB cable. VBUS = 5V?
No
Change Z2001 and check / change C2313
Yes
Measure Tahvo VCCInt voltage from C2303. VCCInt=3.3V?
No
Check C2303 and goto Tahvo trouble shooting
Yes
PC recognizes phone as USB device?
No
Measure USB+ (POP-PORT pin 6) & USB- (POP-PORT pin7) with oscilloscope. Signals present?
No
Change Tahvo (N2300) and test USB connection
Yes
Yes
END

Backup battery troubleshooting

Verify that the backup battery is empty (U<1V). Measure voltage of the battery when the main battery is connected to the phone and the phone is switched on.

Wait a few minutes and monitor that the backup battery voltage is rised. Switch off the phone and disconnect the main battery and monitor that voltage of backup battery is filled. Normal behaviour of the voltage is described pictures.

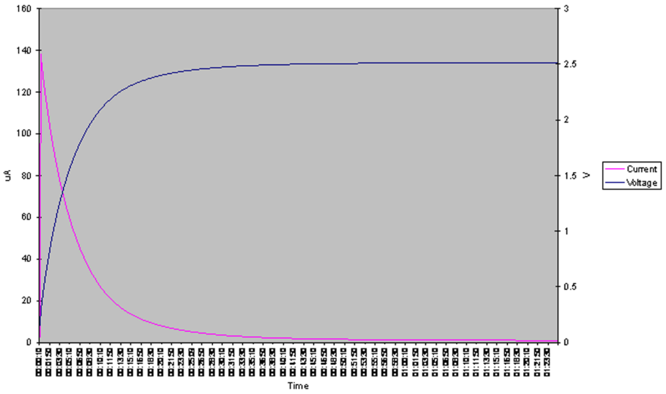


Figure 40 Charging backup battery

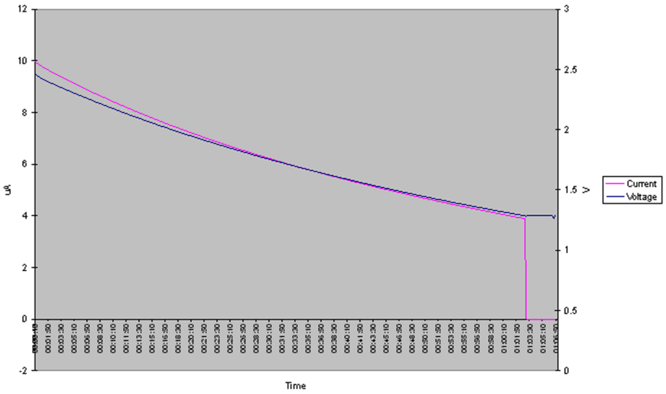
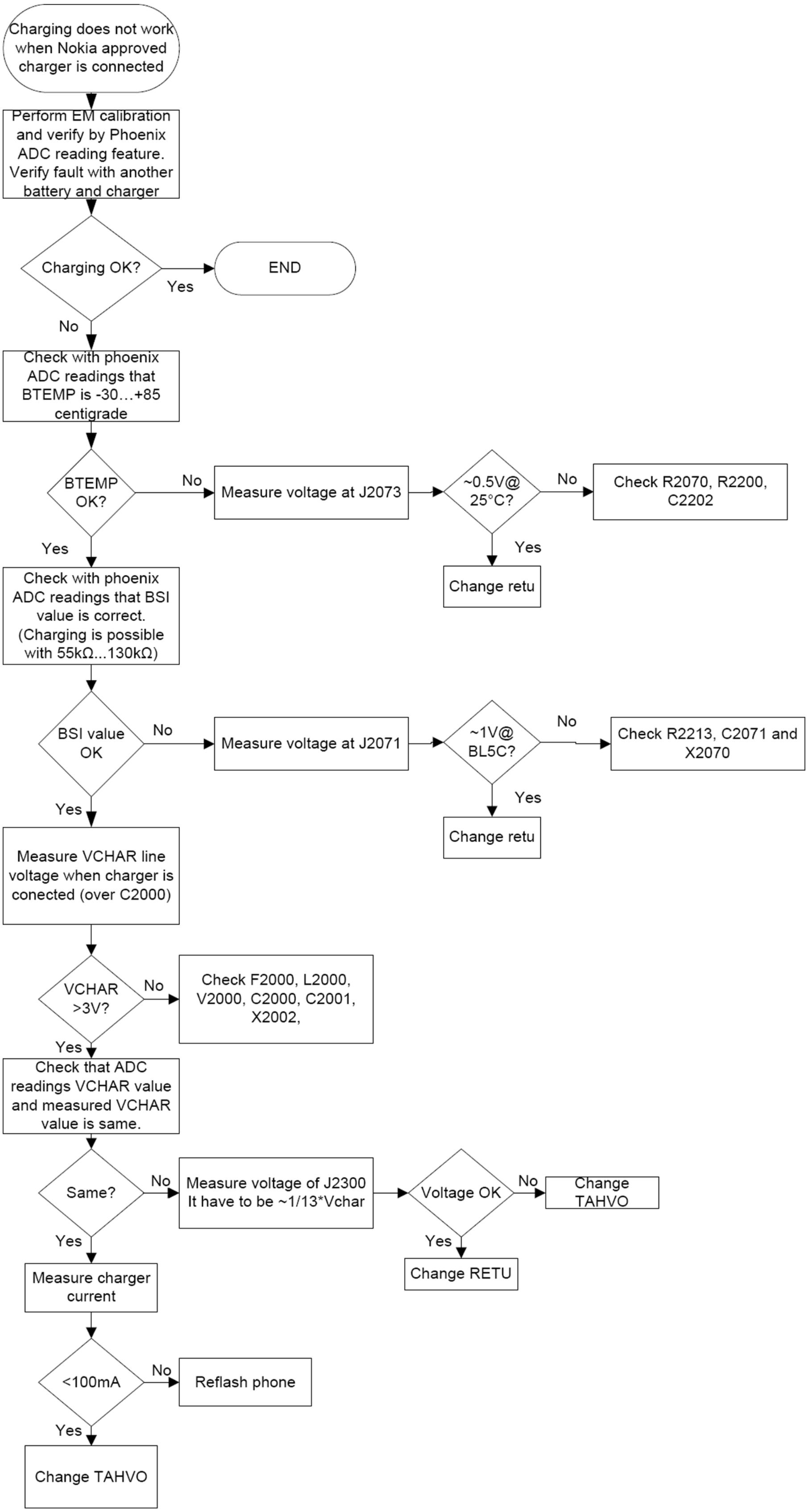


Figure 41 Discharging backup battery

If the voltage rises and falls quickly, battery is dead. If the voltage stays 0V, check resistance VBACK<-> GND: If there is no short circuit, Retu is faulty. Replace Retu.

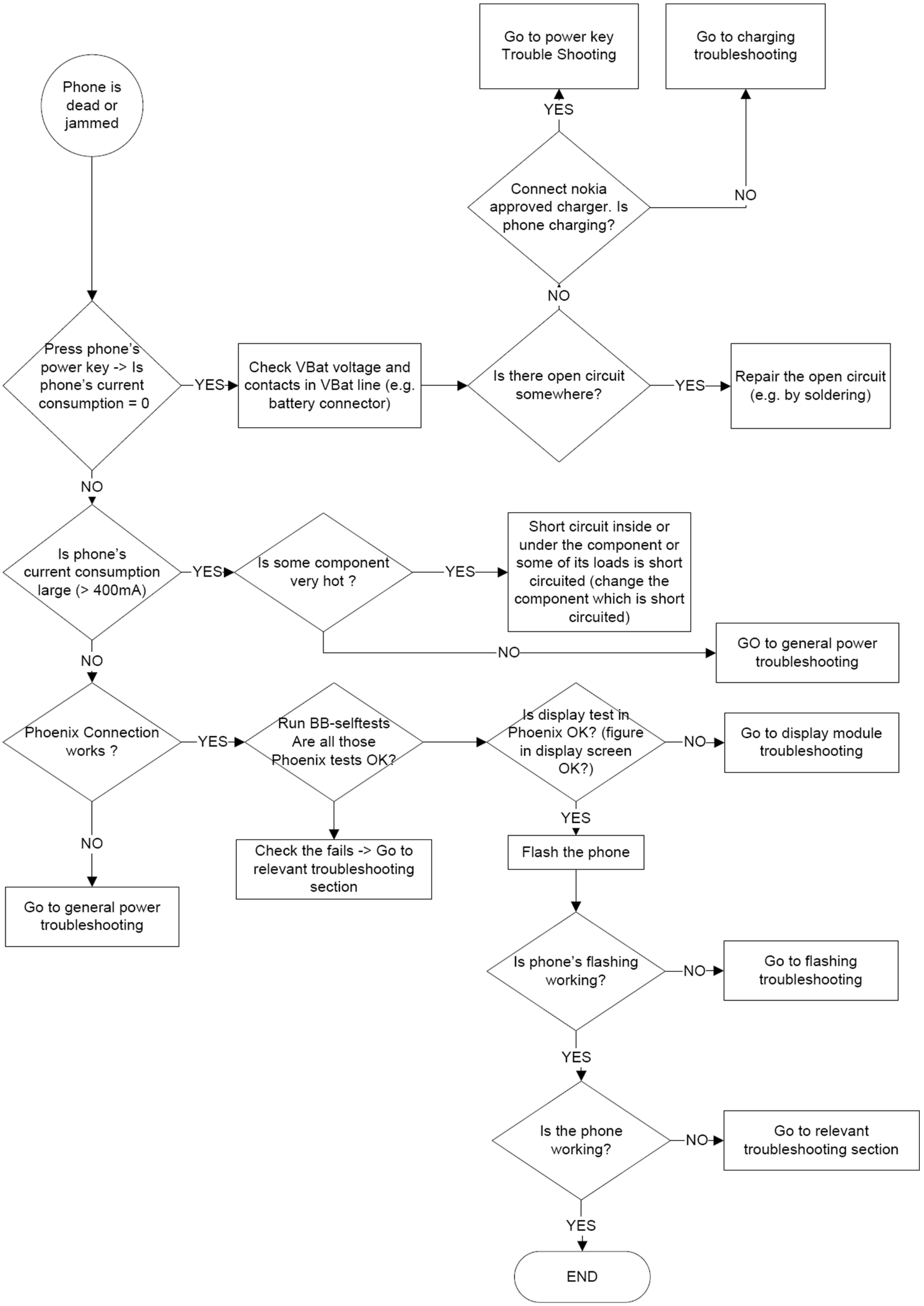
Charging troubleshooting

Troubleshooting flow


Charging does not work when Nokia approved charger is connected
Perform EM calibration and verify by Phoenix ADC reading feature. Verify fault with another battery and charger
Charging OK?
Yes
END
No
Check with phoenix ADC readings that BTEMP is -30…+85 centigrade
BTEMP OK?
No
Measure voltage at J2073
~0.5V@ 25°C?
No
Check R2070, R2200, C2202
Yes
Change retu
Yes
Check with phoenix ADC readings that BSI value is correct. (Charging is possible with 55kΩ...130kΩ)
BSI value OK
No
Measure voltage at J2071
~1V@ BL5C?
No
Check R2213, C2071 and X2070
Yes
Change retu
Yes
Measure VCHAR line voltage when charger is conected (over C2000)
VCHAR >3V?
No
Check F2000, L2000, V2000, C2000, C2001, X2002,
Yes
Check that ADC readings VCHAR value and measured VCHAR value is same.
Same?
No
Measure voltage of J2300 It have to be ~1/13*Vchar
Voltage OK
No
Change TAHVO
Yes
Change RETU
Yes
Measure charger current
<100mA
No
Reflash phone
Yes
Change TAHVO

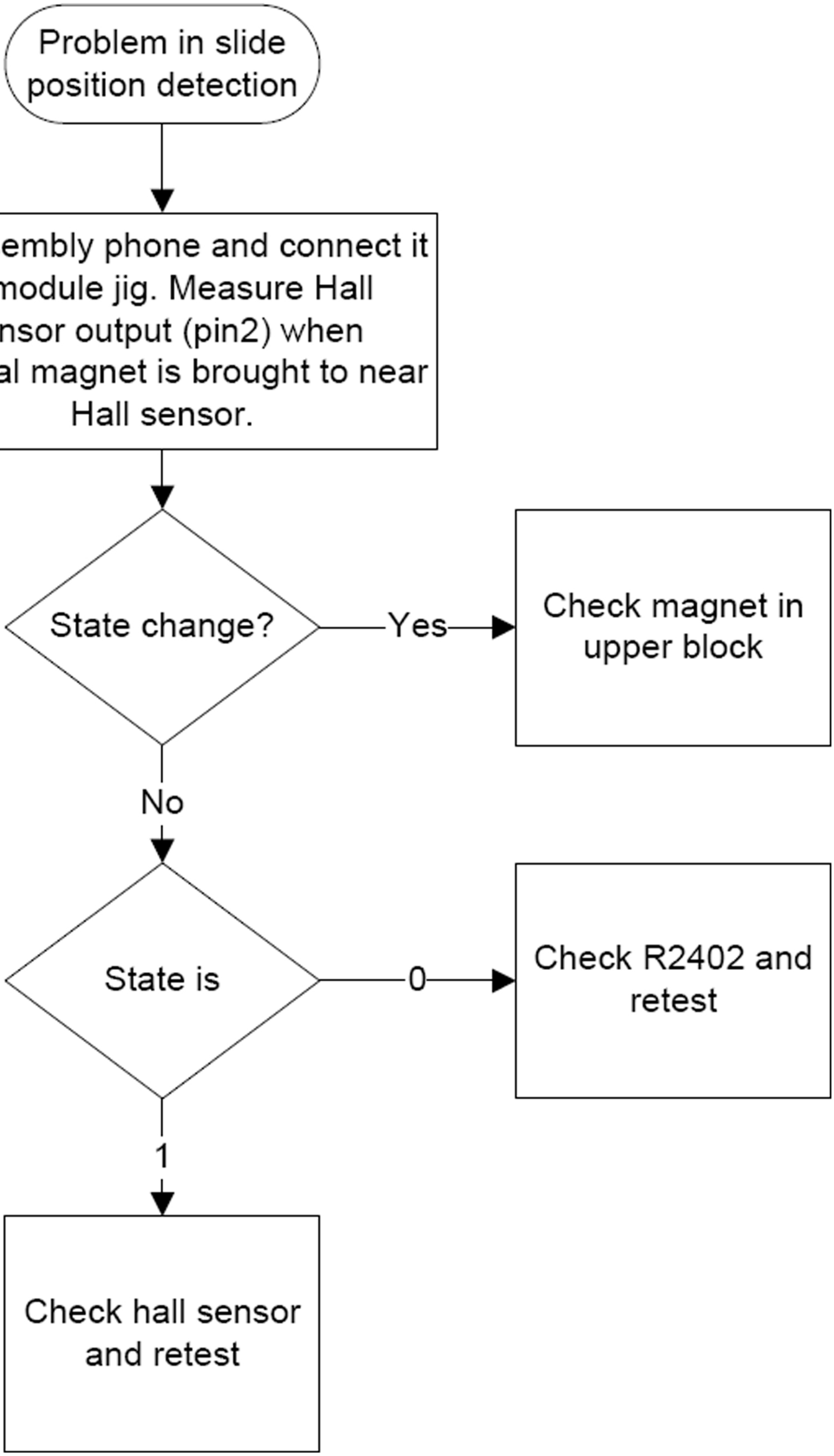
Dead or jammed troubleshooting

Troubleshooting flow


Phone is dead or jammed
Press phone's power key -> Is phone's current consumption = 0
YES
Check VBat voltage and contacts in VBat line (e.g. battery connector)
Is there open circuit somewhere?
YES
Repair the open circuit (e.g. by soldering)
NO
Connect nokia approved charger. Is phone charging?
YES
Go to power key Trouble Shooting
NO
Go to charging troubleshooting
NO
Is phone's current consumption large (> 400mA)
YES
Is some component very hot ?
YES
Short circuit inside or under the component or some of its loads is short circuited (change the component which is short circuited)
NO
GO to general power troubleshooting
NO
Phoenix Connection works ?
YES
Run BB-selftests Are all those Phoenix tests OK?
Check the fails -> Go to relevant troubleshooting section
Is display test in Phoenix OK? (figure in display screen OK?)
NO
Go to display module troubleshooting
YES
Flash the phone
Is phone's flashing working?
NO
Go to flashing troubleshooting
YES
Is the phone working?
NO
Go to relevant troubleshooting section
YES
END
NO
Go to general power troubleshooting

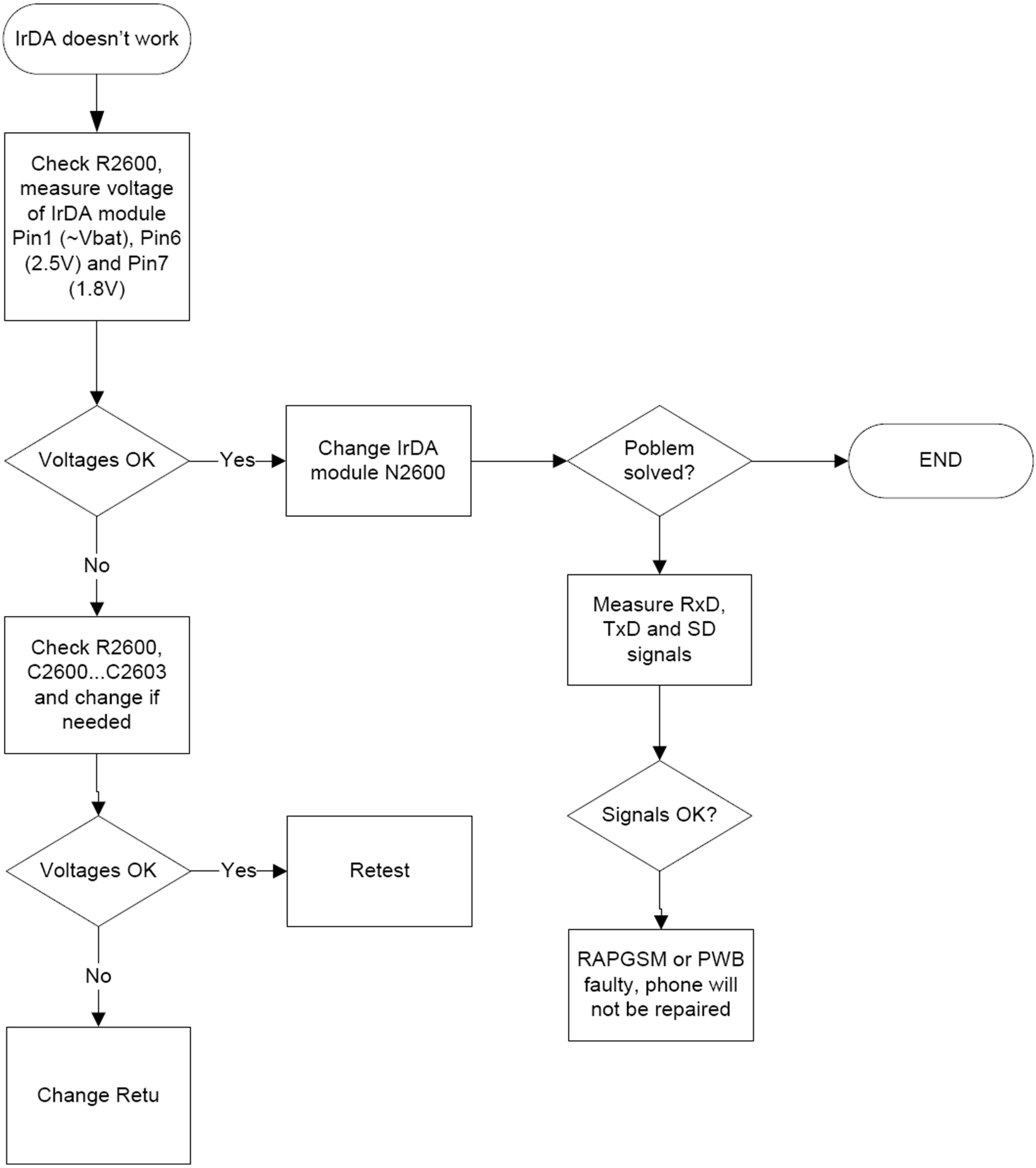
Hall sensor troubleshooting

Troubleshooting flow


Problem in slide position detection
Disassembly phone and connect it to module jig. Measure Hall sensor output (pin2) when external magnet is brought to near Hall sensor.
State change?
Yes
Check magnet in upper block
No
State is
0
Check R2402 and retest
1
Check hall sensor and retest

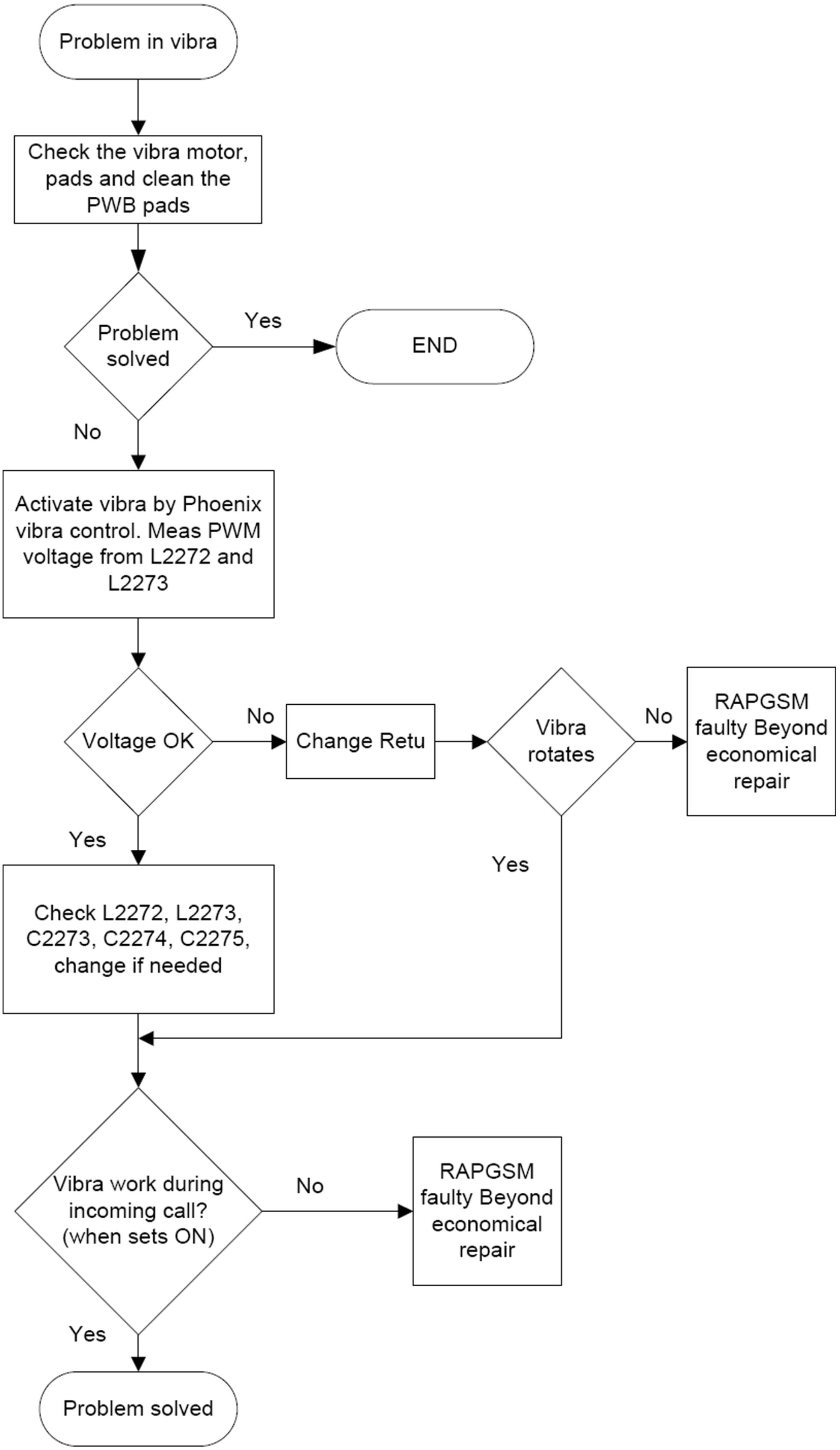
Irda troubleshooting

Troubleshooting flow


IrDA doesn't work
Check R2600, measure voltage of IrDA module Pin1 (~Vbat), Pin6 (2.5V) and Pin7 (1.8V)
Voltages OK
Yes
Change IrDA module N2600
Poblem solved?
END
No
Check R2600, C2600...C2603 and change if needed
Measure RxD, TxD and SD signals
Voltages OK
Yes
Retest
Signals OK?
No
RAPGSM or PWB faulty, phone will not be repaired
Change Retu

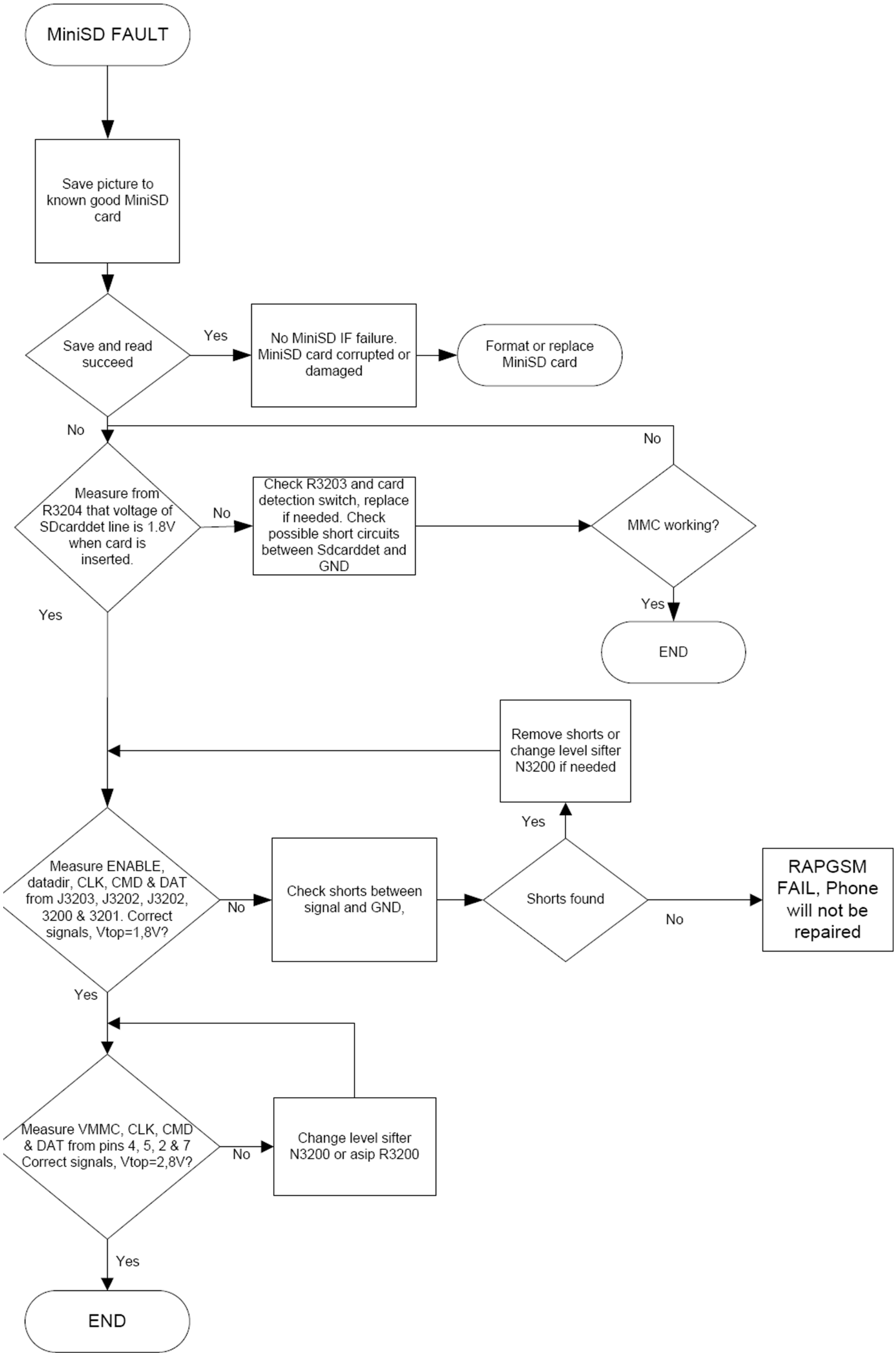
Vibra troubleshooting

Troubleshooting flow


Problem in vibra
Check the vibra motor, pads and clean the PWB pads
Problem solved
Yes
END
No
Activate vibra by Phoenix vibra control. Meas PWM voltage from L2272 and L2273
Voltage OK
No
Change Retu
Vibra rotates
No
RAPGSM faulty Beyond economical repair
Yes
Check L2272, L2273, C2273, C2274, C2275, change if needed
Yes
Vibra work during incoming call? (when sets ON)
No
RAPGSM faulty Beyond economical repair
Yes
Problem solved

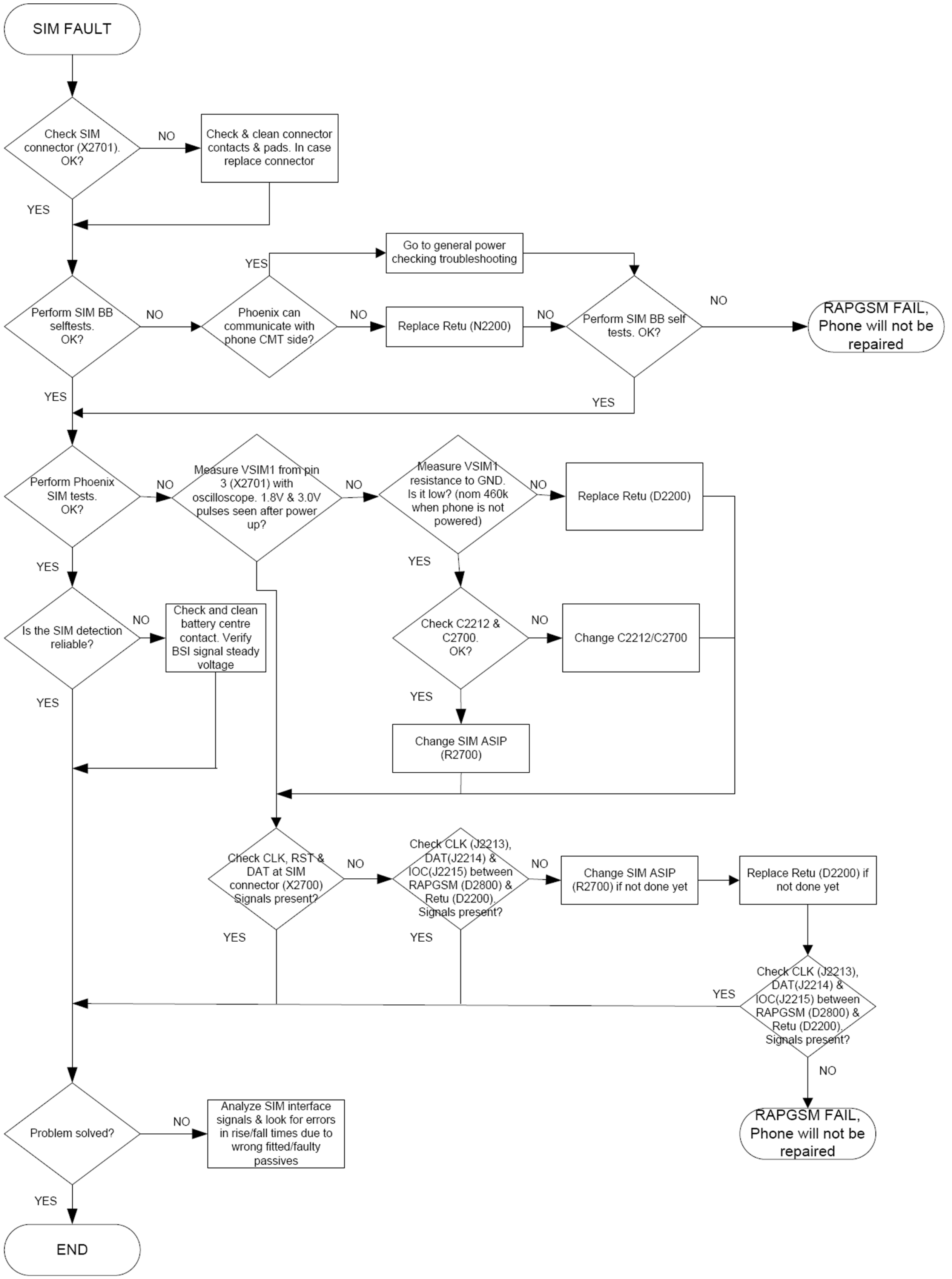
MiniSD troubleshooting

Troubleshooting flow


MiniSD FAULT
Save picture to known good MiniSD card
Save and read succeed
Yes
No MiniSD IF failure. MiniSD card corrupted or damaged
Format or replace MiniSD card
No
No
Measure from R3204 that voltage of SDcarddet line is 1.8V when card is inserted.
No
Check R3203 and card detection switch, replace if needed. Check possible short circuits between Sdcarddet and GND
MMC working?
Yes
END
Yes
Remove shorts or change level sifter N3200 if needed
Yes
Measure ENABLE, datadir, CLK, CMD & DAT from J3203, J3202, 3200 & 3201. Correct signals, Vtop=1,8V?
No
Check shorts between signal and GND,
Shorts found
No
RAPGSM FAIL, Phone will not be repaired
Yes
Measure VMMC, CLK, CMD & DAT from pins 4, 5, 2 & 7 Correct signals, Vtop=2,8V?
No
Change level sifter N3200 or asip R3200
Yes
END

SIM troubleshooting

Troubleshooting flow


SIM FAULT
Check SIM connector (X2701). OK?
NO
Check & clean connector contacts & pads. In case replace connector
YES
Go to general power checking troubleshooting
YES
Perform SIM BB selftests. OK?
NO
Phoenix can communicate with phone CMT side?
NO
Replace Retu (N2200)
NO
Perform SIM BB self tests. OK?
NO
RAPGSM FAIL, Phone will not be repaired
YES
YES
Perform Phoenix SIM tests. OK?
NO
Measure VSIM1 from pin 3 (X2701) with oscilloscope. 1.8V & 3.0V pulses seen after power up?
NO
Measure VSIM1 resistance to GND. Is it low? (nom 460k when phone is not powered)
NO
Replace Retu (D2200)
YES
YES
Is the SIM detection reliable?
NO
Check and clean battery centre contact. Verify BSI signal steady voltage
Check C2212 & C2700. OK?
NO
Change C2212/C2700
YES
YES
Change SIM ASIP (R2700)
Check CLK, RST & DAT at SIM connector (X2700) Signals present?
NO
Check CLK (J2213), DAT(J2214) & IOC(J2215) between RAPGSM (D2800) & Retu (D2200). Signals present?
NO
Change SIM ASIP (R2700) if not done yet
Replace Retu (D2200) if not done yet
YES
YES
YES
Check CLK (J2213), DAT(J2214) & IOC(J2215) between RAPGSM (D2800) & Retu (D2200). Signals present?
NO
RAPGSM FAIL, Phone will not be repaired
Problem solved?
NO
Analyze SIM interface signals & look for errors in rise/fall times due to wrong fitted/faulty passives
YES
END

Display module troubleshooting

General instructions for display troubleshooting

The first step is to verify with a working display that the fault is not on the display module itself. The display module cannot be repaired.

The second step is to check that the cellular engine is working normally. This can be done by connecting the phone to a docking station and starting Phoenix service software. With the help of Phoenix read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).

After these checks proceed to the display troubleshooting flowcharts. Use the Display Test tool in Phoenix to find the detailed fault mode.

Operating modes of the display

The display is in a normal mode when the phone is in active use.

The display is in a partial idle mode when the phone is in the screen saver mode.

The operating modes of the display can be controlled with the help of Phoenix.

Table 7 Display module troubleshooting cases

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. Backlight is also controlled automatically by the ambient light sensor. This means that in case the display is working (image OK), but the backlight is not, follow the Display and Keyboard Backlight troubleshooting.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table.

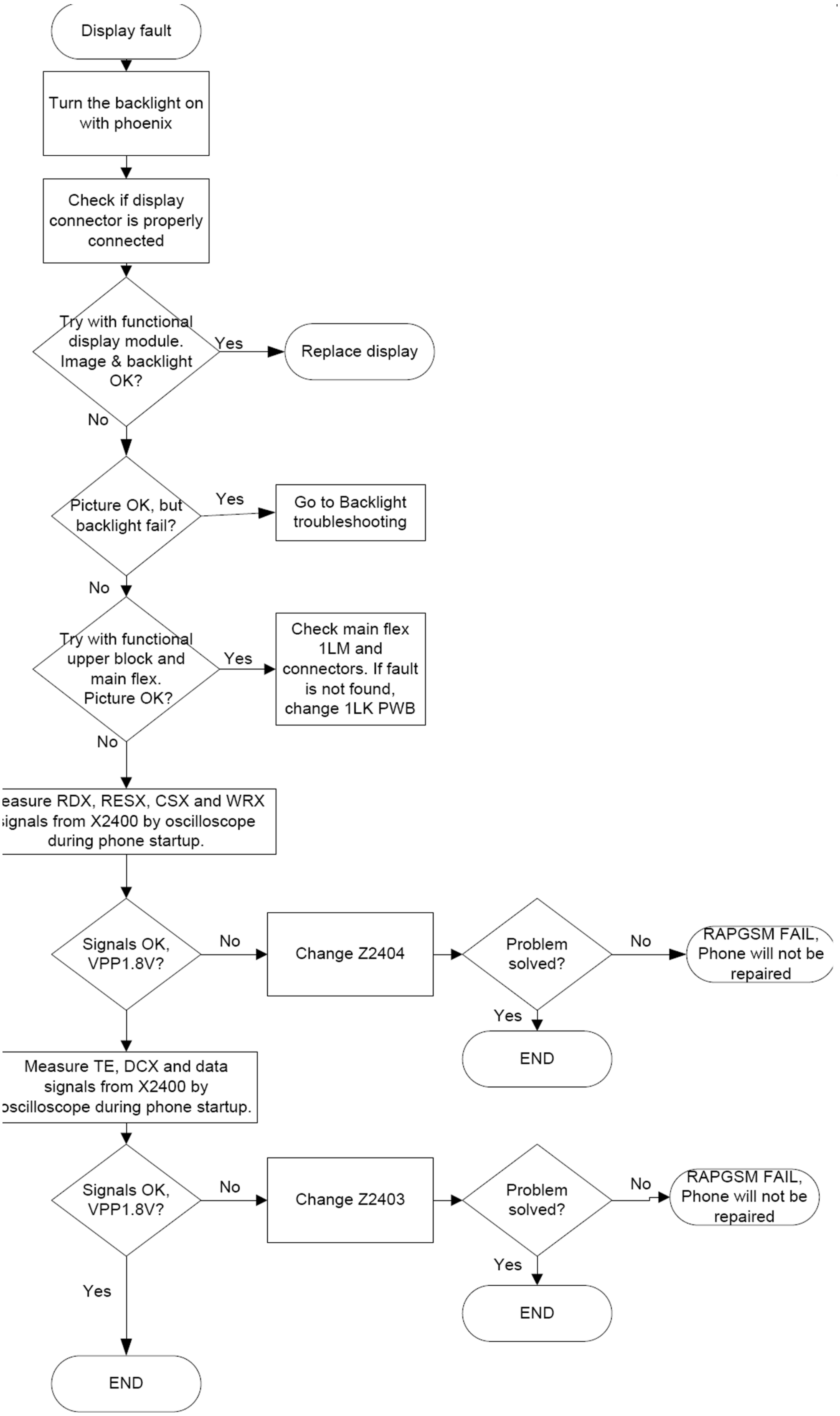
Table 8 Pixel defects

Item		White dot defect				Black dot defect	Total
1	Defect counts	R	G	B	White Dot Total	1	1
		1	1	1	1		
2	Combined defect counts	Not allowed. Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.					

Note: Blinking pixels are not allowed in normal operating temperatures and light conditions.

Display fault troubleshooting

Troubleshooting flow

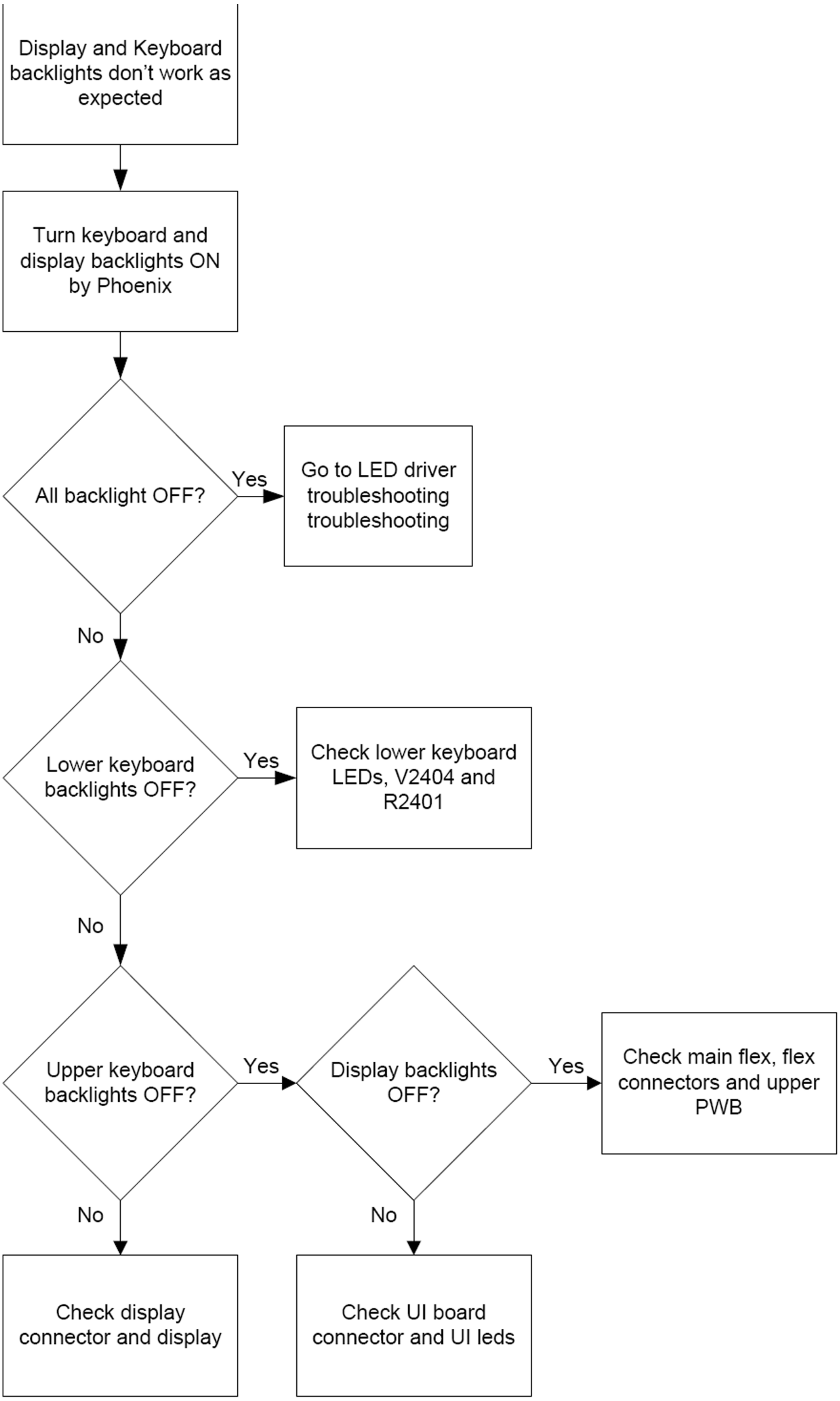

Display fault
Turn the backlight on with phoenix
Check if display connector is properly connected
Try with functional display module. Image & backlight OK?
Yes
Replace display
No
Picture OK, but backlight fail?
Yes
Go to Backlight troubleshooting
No
Try with functional upper block and main flex. Picture OK?
Yes
Check main flex 1LM and connectors. If fault is not found, change 1LK PWB
No
easure RDX, RESX, CSX and WRX signals from X2400 by oscilloscope during phone startup.
Signals OK, VPP1.8V?
No
Change Z2404
Problem solved?
No
RAPGSM FAIL, Phone will not be repaired
Yes
END
Measure TE, DCX and data signals from X2400 by oscilloscope during phone startup.
Signals OK, VPP1.8V?
No
Change Z2403
Problem solved?
No
RAPGSM FAIL, Phone will not be repaired
Yes
END
Yes
END

Display and keyboard backlight troubleshooting

Context

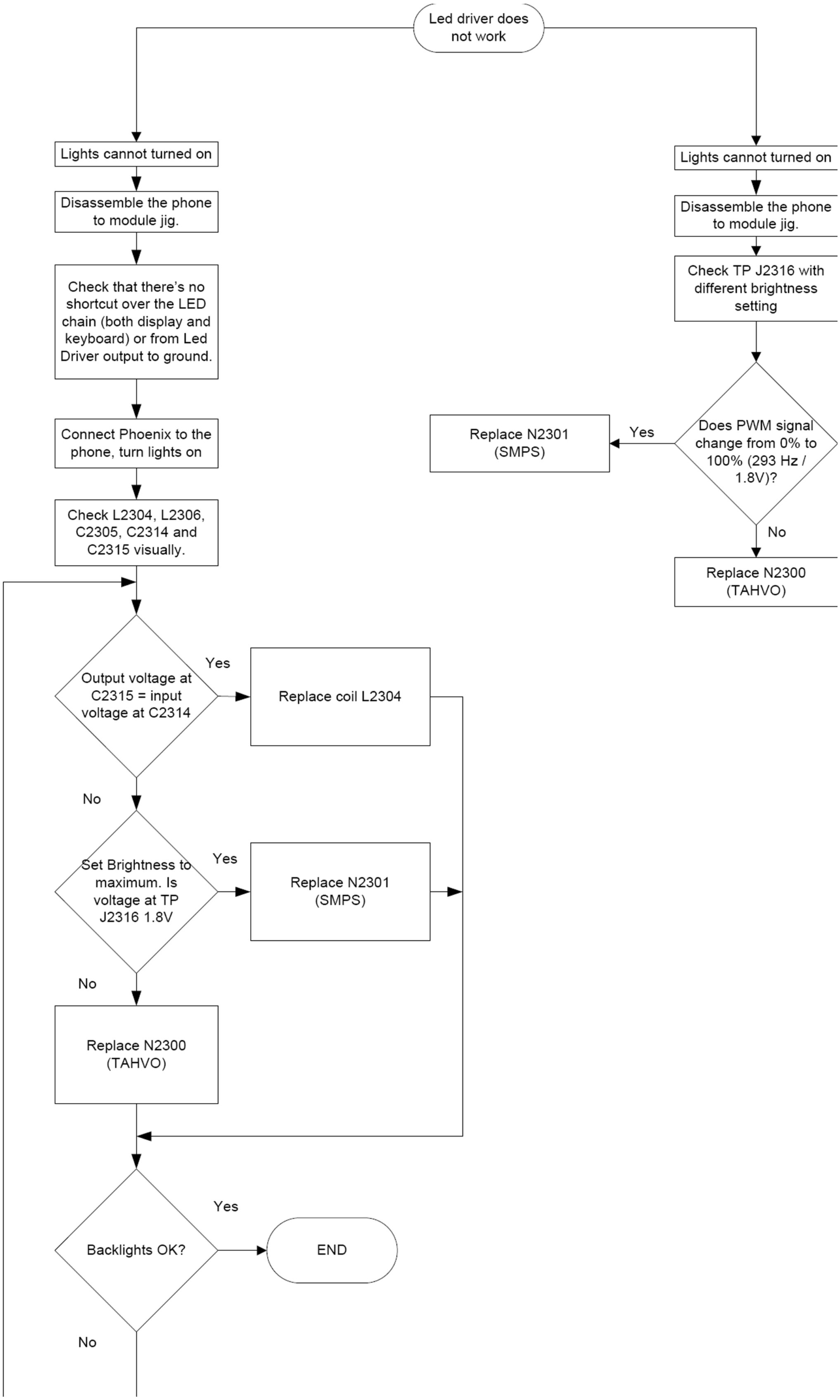
The device has one LED driver that provides current for both display and keyboard backlights. Lower keyboard backlights are turned ON if slider is open. This is controlled by the Hall sensor. Backlight brightness can be adjusted manually by Phoenix.

Troubleshooting flow


Display and Keyboard backlights don't work as expected
Turn keyboard and display backlights ON by Phoenix
All backlight OFF?
Yes
Go to LED driver troubleshooting troubleshooting
No
Lower keyboard backlights OFF?
Yes
Check lower keyboard LEDs, V2404 and R2401
No
Upper keyboard backlights OFF?
Yes
Display backlights OFF?
Yes
Check main flex, flex connectors and upper PWB
No
Check display connector and display
No
Check UI board connector and UI leds

LED driver troubleshooting

Troubleshooting flow


Led driver does not work
Lights cannot turned on
Disassemble the phone to module jig.
Check that there's no shortcut over the LED chain (both display and keyboard) or from Led Driver output to ground.
Connect Phoenix to the phone, turn lights on
Check L2304, L2306, C2305, C2314 and C2315 visually.
Output voltage at C2315 = input voltage at C2314
Yes
Replace coil L2304
No
Set Brightness to maximum. Is voltage at TP J2316 1.8V
Yes
Replace N2301 (SMPS)
No
Replace N2300 (TAHVO)
Backlights OK?
Yes
END
No
Lights cannot turned on
Disassemble the phone to module jig.
Check TP J2316 with different brightness setting
Does PWM signal change from 0% to 100% (293 Hz / 1.8V)?
Yes
Replace N2301 (SMPS)
No
Replace N2300 (TAHVO)

Bluetooth troubleshooting

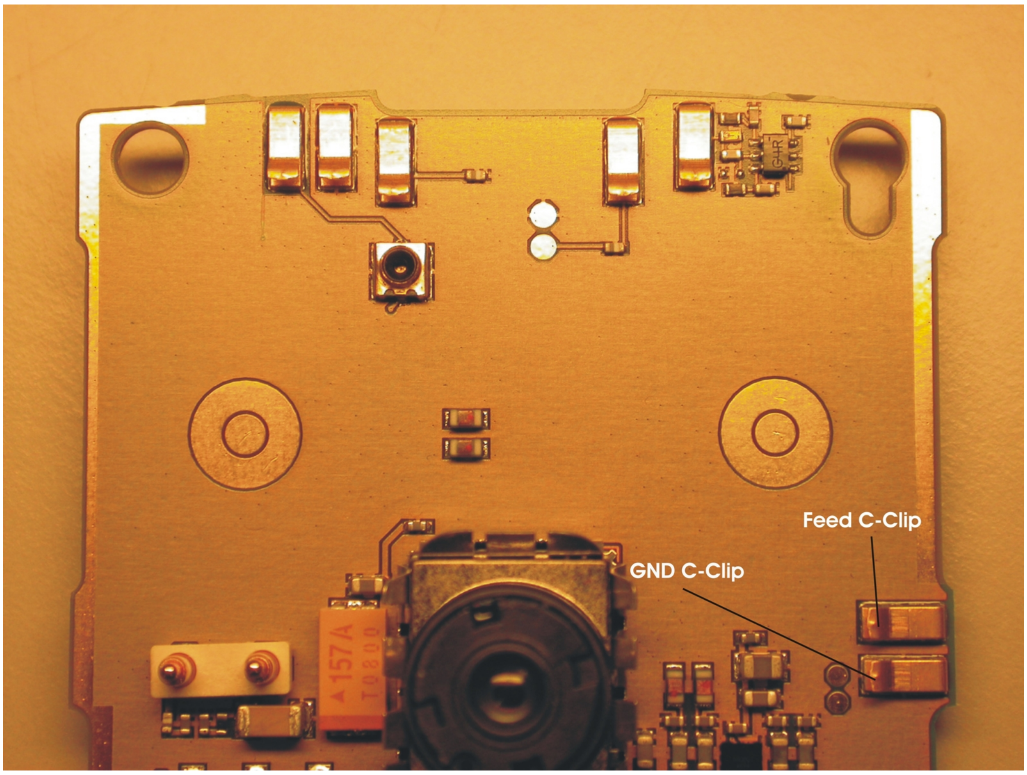
Introduction to Bluetooth/FM Radio troubleshooting

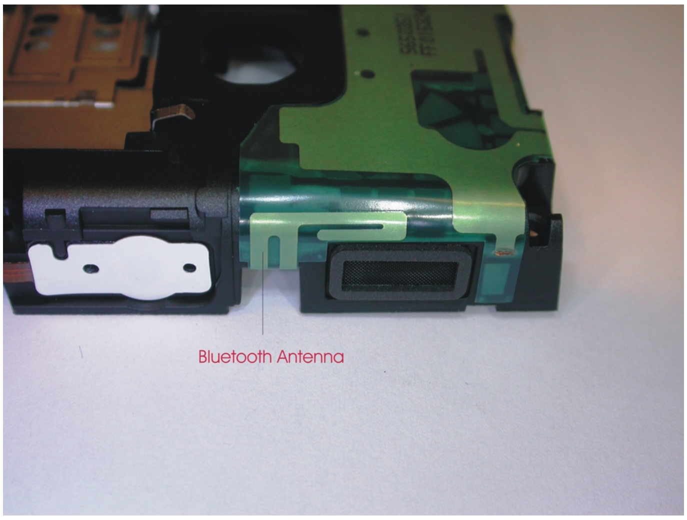
There are two main Bluetooth problems that can occur:

Problem	Description
Detachment of the BT antenna.	This would most likely happen if the device has been dropped repeatedly to the ground. It could cause the BT antenna to become loose or partially detached from the PWB. (see next page for details about BT antenna HW and Mechanics)
A malfunction in the BT ASIC, BB ASICs or Phone's BT SMD components.	This is unpredictable and could have many causes i.e. SW or HW related.

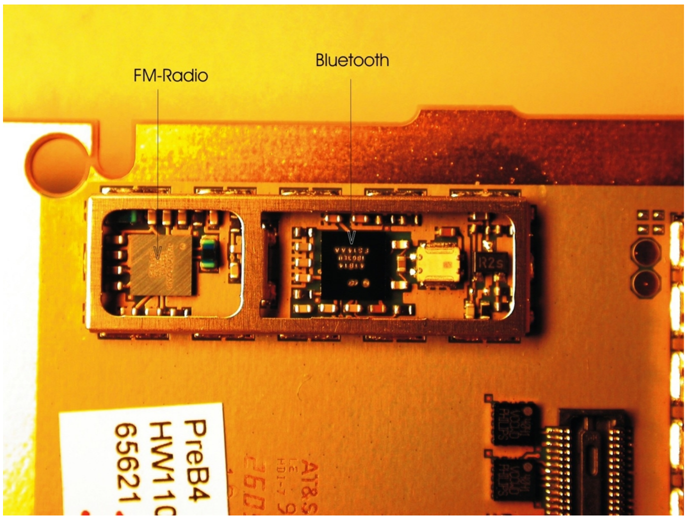
The main issue is to find out if the problem is related to the BT antenna or related to the BT system or the phone's BB and then replace/fix the faulty component.

Location of the BT antenna

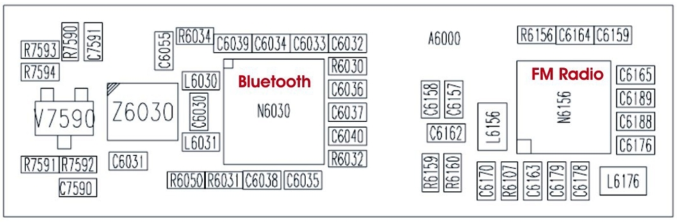



Bluetooth Antenna

Bluetooth/FM Radio layout


FM-Radio
Bluetooth
PreB4
HW11C
65621

Bluetooth/FM Radio component layout


R7593
R7590
C7591
R7594
V7590
R7591
R7592
C7590
Z6030
C6031
C6055
R6034
C6039
C6034
C6033
C6032
L6030
C6030
L6031
Bluetooth
N6030
R6030
C6036
C6037
C6040
R6032
R6050
R6031
C6038
C6035
A6000
R6156
C6164
C6159
C6158
C6157
C6162
L6156
FM Radio
N6156
C6165
C6189
C6188
C6176
R6159
R6160
C6170
R6107
C6163
C6179
C6178
L6176

Bluetooth settings for Phoenix

Steps

1. Start *Phoenix* service software.
2. From the **File** menu, choose **Open Product**, and then choose the correct type designator from the **Product** list.
3. Place the phone to a flash adapter in the local mode.
4. Choose **Testing→Bluetooth LOCALS** .

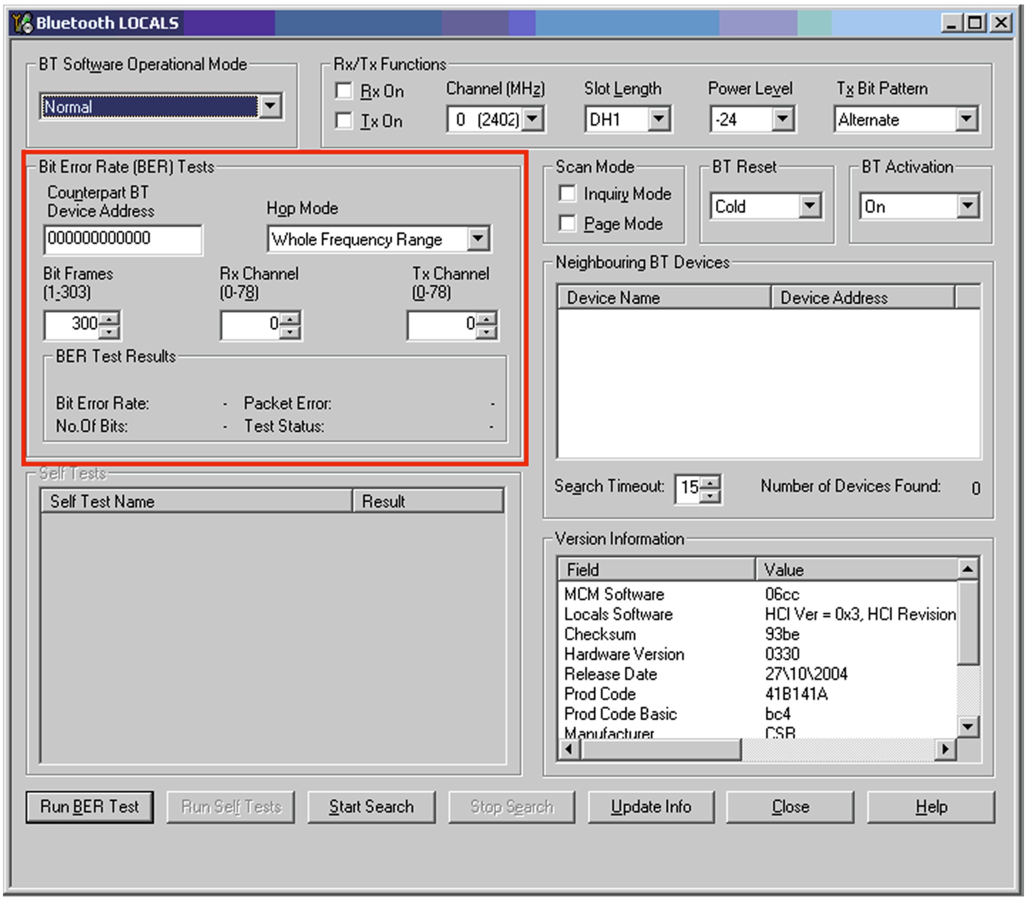
5. Locate JBT-9's serial number (12 digits) found in the type label on the back of JBT-9.

   In addition to JBT-9, also JBT-3 and JBT-6 Bluetooth test boxes can be used.
6. In the *Bluetooth LOCALS* window, write the 12-digit serial number on the **Counterpart BT Device Address** line.

   This needs to be done only once provided that JBT-9 is not changed.
7. Place the JBT-9 box near (within 10 cm) the BT antenna and click **Run BER Test**.

Results

Bit Error Rate test result is displayed in the *Bit Error Rate (BER) Tests* pane in the *Bluetooth LOCALS* window.


Bluetooth LOCALS
BT Software Operational Mode
Rx/Tx Functions
Bit Error Rate (BER) Tests
BER Test Results
Scan Mode
BT Reset
BT Activation
Neighbouring BT Devices
Self Tests
Version Information
Run BER Test
Run Self Tests
Start Search
Stop Search
Update Info
Close
Help

BT Software Operational Mode: Normal

☐ Rx On
☐ Tx On

Channel (MHz): 0 (2402)
Slot Length: DH1
Power Level: -24
Tx Bit Pattern: Alternate

Counterpart BT Device Address: 000000000000
Hop Mode: Whole Frequency Range
Bit Frames (1-303): 300
Rx Channel (0-78): 0
Tx Channel (0-78): 0

Bit Error Rate: -
Packet Error: -
No.Of Bits: -
Test Status: -

☐ Inquiry Mode
☐ Page Mode

BT Reset: Cold
BT Activation: On

Device Name	Device Address

Search Timeout: 15
Number of Devices Found: 0

Self Test Name	Result

Field	Value
MCM Software	06cc
Locals Software	HCI Ver = 0x3, HCI Revision
Checksum	93be
Hardware Version	0330
Release Date	27\10\2004
Prod Code	41B141A
Prod Code Basic	bc4
Manufacturer	CSR

Figure 42 BER test result

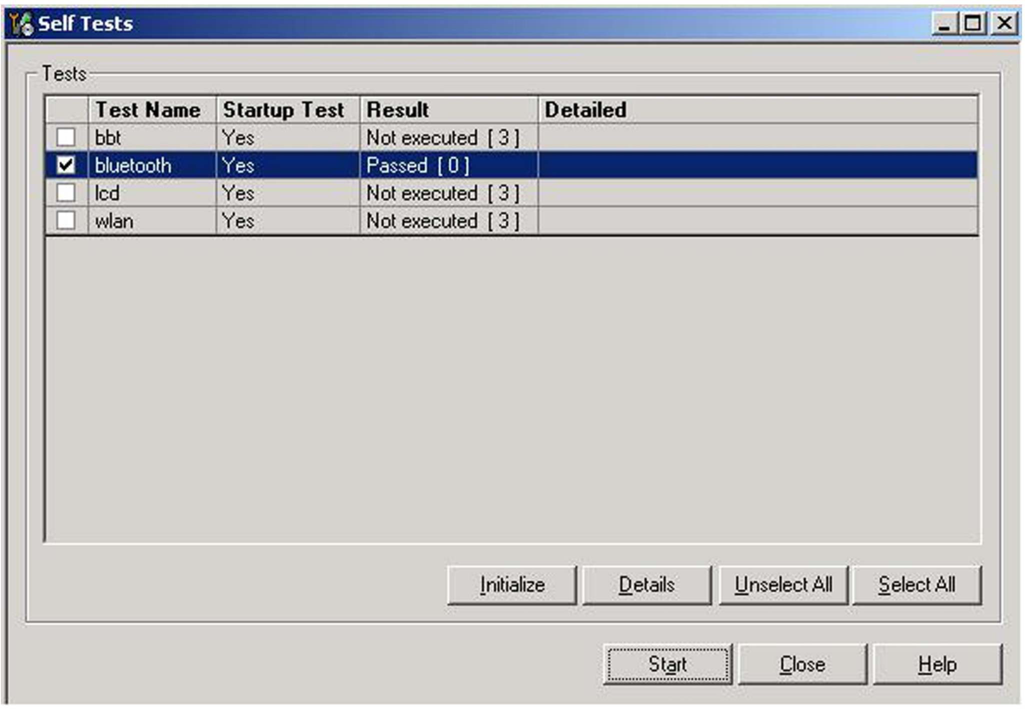
Bluetooth self tests in Phoenix

Steps

1. Start *Phoenix* service software.
2. Choose**File→Scan Product.**
3. Place the phone to a flash adapter.
4. From the **Mode** drop-down menu, set mode to **Local**.
5. Choose **Testing→Self Tests.**
6. In the *Self Tests* window check the following Bluetooth related tests:
   - **ST_LPRF_IF_TEST**
   - **ST_LPRF_AUDIO_LINES_TEST**

- **ST_BT_WAKEUP_TEST**

7. To run the tests, click **Start**.

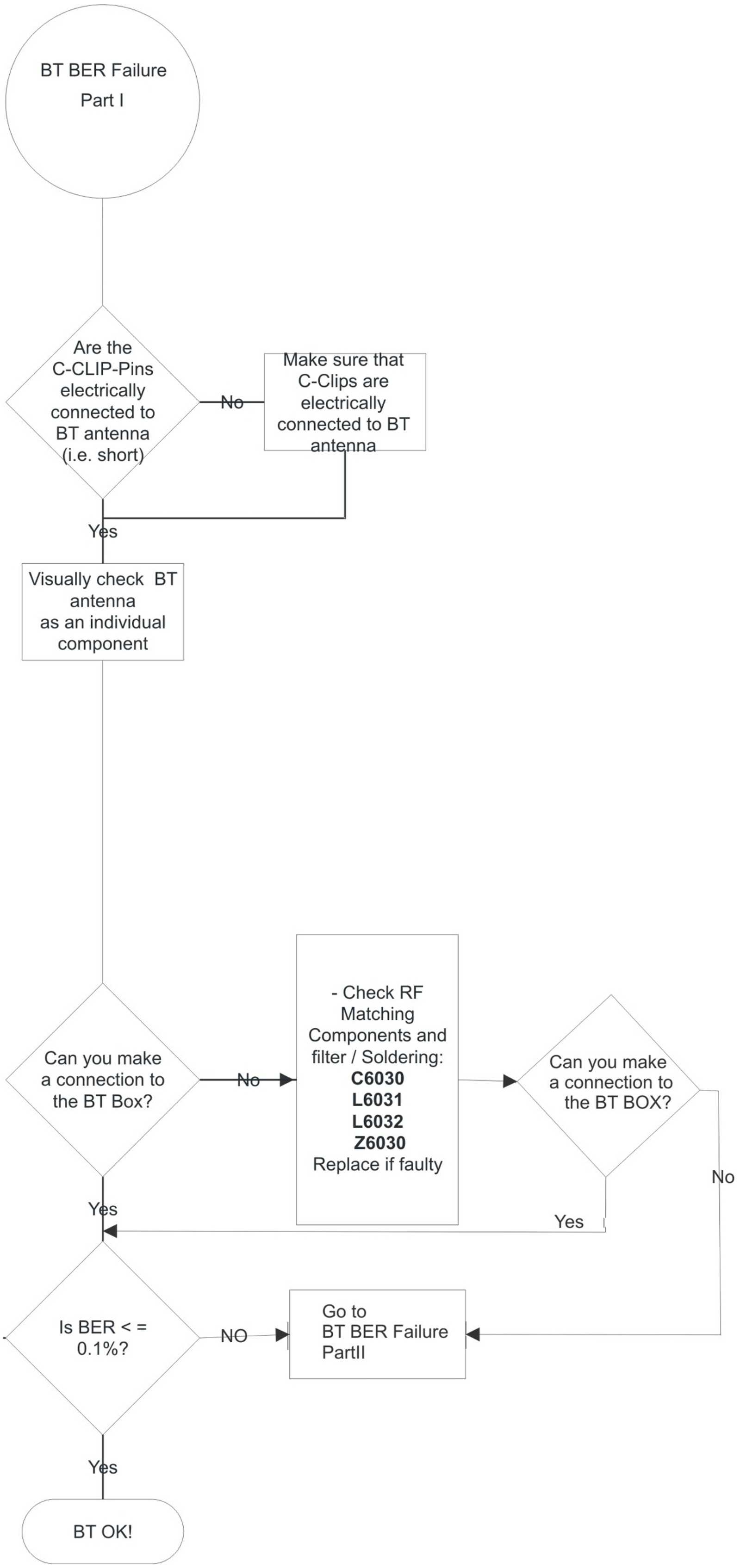

Self Tests
Tests
Initialize
Details
Unselect All
Select All
Start
Close
Help

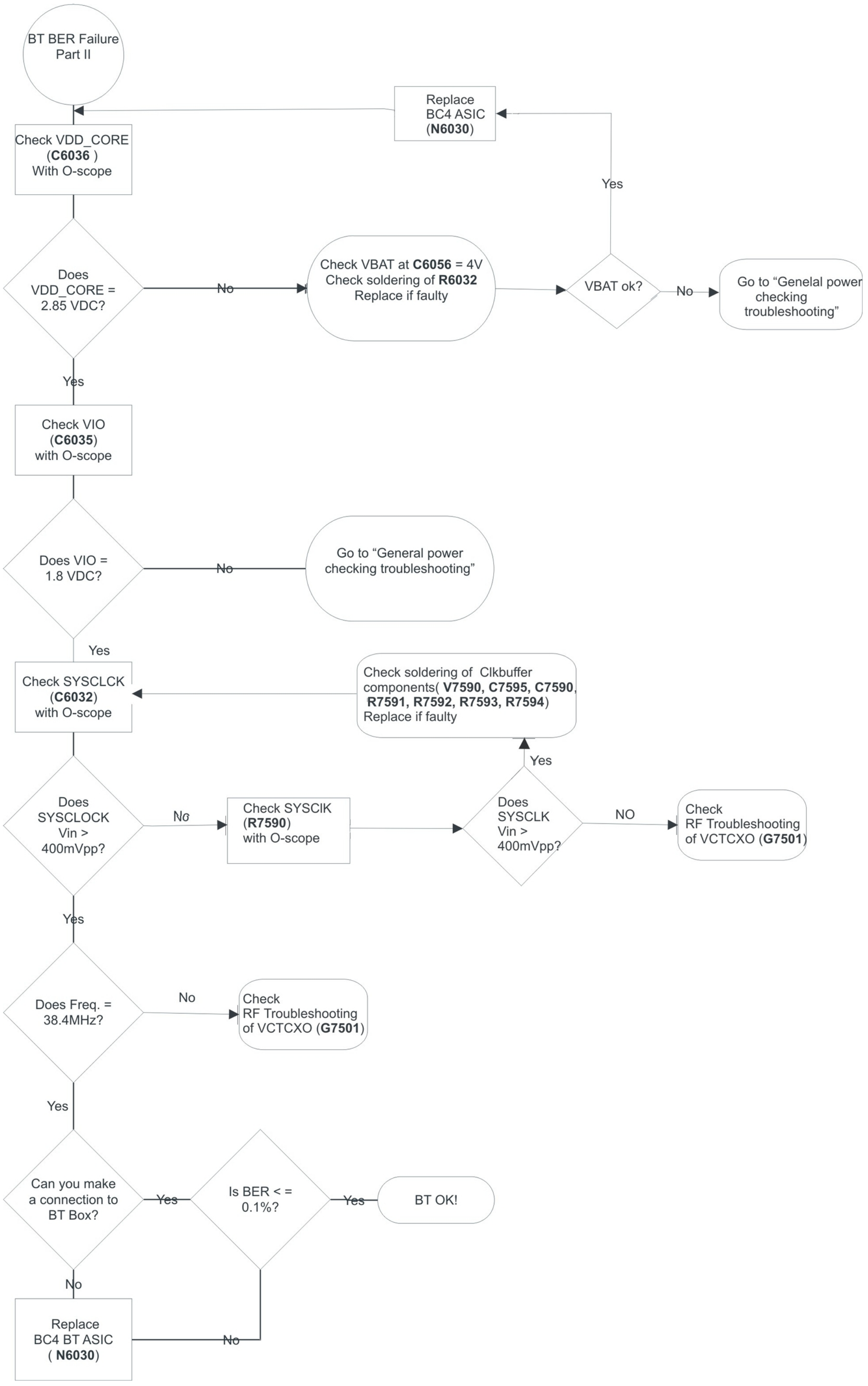
	Test Name	Startup Test	Result	Detailed
☐	bbt	Yes	Not executed [3]	
☑	bluetooth	Yes	Passed [0]	
☐	lcd	Yes	Not executed [3]	
☐	wlan	Yes	Not executed [3]	

Figure 43 Bluetooth self tests in *Phoenix*

Bluetooth BER failure troubleshooting

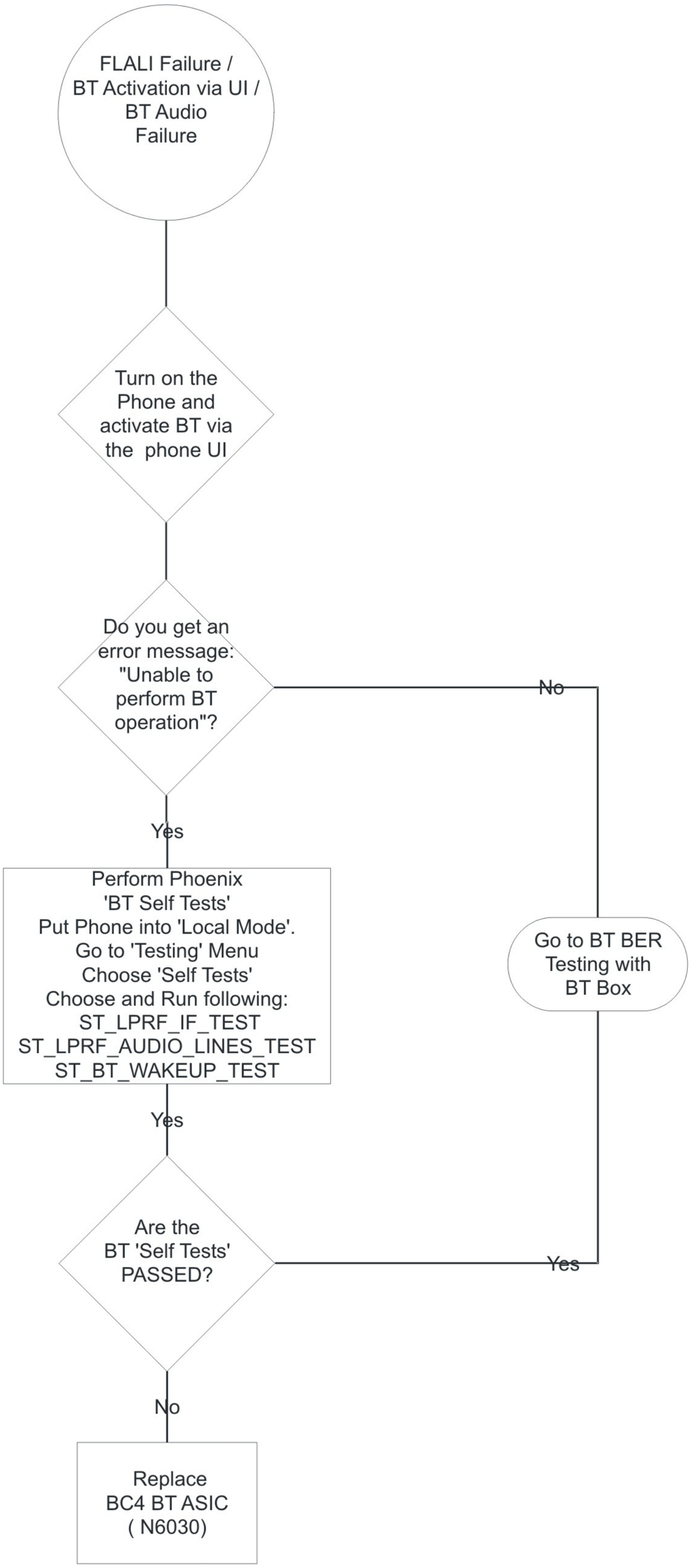
Troubleshooting flow


BT BER Failure
Part I
Are the C-CLIP-Pins electrically connected to BT antenna (i.e. short)
No
Make sure that C-Clips are electrically connected to BT antenna
Yes
Visually check BT antenna as an individual component
Can you make a connection to the BT Box?
No
- Check RF Matching Components and filter / Soldering:
C6030
L6031
L6032
Z6030
Replace if faulty
Can you make a connection to the BT BOX?
No
Yes
Yes
Is BER < = 0.1%?
NO
Go to BT BER Failure PartII
Yes
BT OK!


BT BER Failure Part II
Replace BC4 ASIC (N6030)
Check VDD_CORE (C6036) With O-scope
Yes
Does VDD_CORE = 2.85 VDC?
No
Check VBAT at C6056 = 4V Check soldering of R6032 Replace if faulty
VBAT ok?
No
Go to "Genelal power checking troubleshooting"
Yes
Check VIO (C6035) with O-scope
Does VIO = 1.8 VDC?
No
Go to "General power checking troubleshooting"
Yes
Check SYSCLCK (C6032) with O-scope
Check soldering of Clkbuffer components(V7590, C7595, C7590, R7591, R7592, R7593, R7594) Replace if faulty
Yes
Does SYSCLOCK Vin > 400mVpp?
No
Check SYSCIK (R7590) with O-scope
Does SYSCLK Vin > 400mVpp?
NO
Check RF Troubleshooting of VCTCXO (G7501)
Yes
Does Freq. = 38.4MHz?
No
Check RF Troubleshooting of VCTCXO (G7501)
Yes
Can you make a connection to BT Box?
Yes
Is BER < = 0.1%?
Yes
BT OK!
No
Replace BC4 BT ASIC (N6030)
No

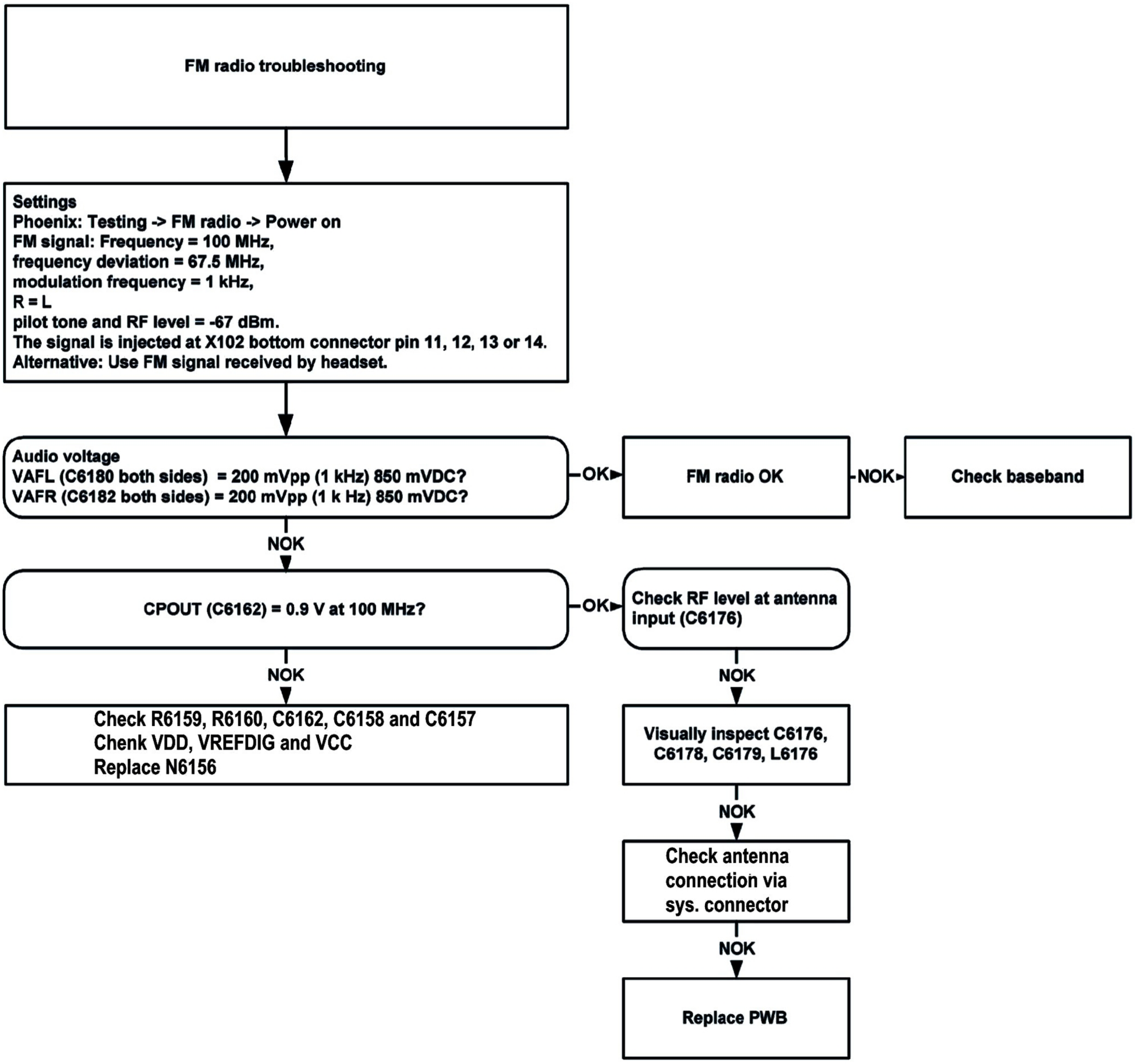
BT audio failure troubleshooting

Troubleshooting flow


FLALI Failure / BT Activation via UI / BT Audio Failure
Turn on the Phone and activate BT via the phone UI
Do you get an error message: "Unable to perform BT operation"?
No
Yes
Perform Phoenix 'BT Self Tests'
Put Phone into 'Local Mode'.
Go to 'Testing' Menu
Choose 'Self Tests'
Choose and Run following:
ST_LPRF_IF_TEST
ST_LPRF_AUDIO_LINES_TEST
ST_BT_WAKEUP_TEST
Go to BT BER Testing with BT Box
Yes
Are the BT 'Self Tests' PASSED?
Yes
No
Replace BC4 BT ASIC (N6030)

FM Radio troubleshooting

Troubleshooting flow


FM radio troubleshooting
Settings
Phoenix: Testing -> FM radio -> Power on
FM signal: Frequency = 100 MHz,
frequency deviation = 67.5 MHz,
modulation frequency = 1 kHz,
R = L
pilot tone and RF level = -67 dBm.
The signal is injected at X102 bottom connector pin 11, 12, 13 or 14.
Alternative: Use FM signal received by headset.
Audio voltage
VAFL (C6180 both sides) = 200 mVpp (1 kHz) 850 mVDC?
VAFR (C6182 both sides) = 200 mVpp (1 k Hz) 850 mVDC?
OK
FM radio OK
NOK
Check baseband
NOK
CPOUT (C6162) = 0.9 V at 100 MHz?
OK
Check RF level at antenna input (C6176)
NOK
Check R6159, R6160, C6162, C6158 and C6157
Chenk VDD, VREFDIG and VCC
Replace N6156
NOK
Visually inspect C6176, C6178, C6179, L6176
NOK
Check antenna connection via sys. connector
NOK
Replace PWB

Audio troubleshooting

Audio troubleshooting test instructions

Differential external earpiece and internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be either single-ended or differential.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Current probe (Internal handsfree PWM output measurement)
- Phoenix service software
- Battery voltage 3.7V

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- Internal microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

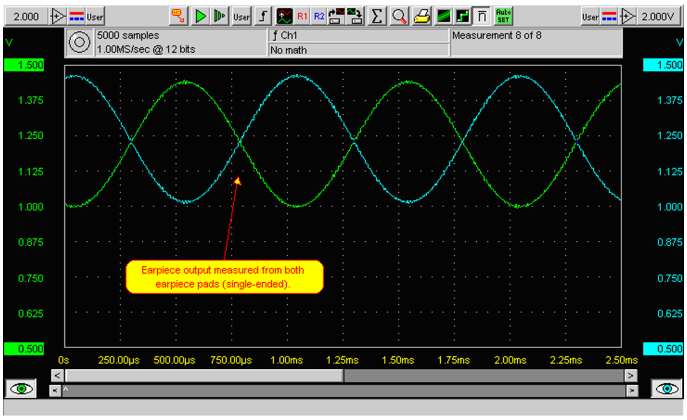
Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to External Earpiece	XMICP and GND	HSEAR R P, HSEAR R N and GND	-2.9	1000	720	1.2	NA
		HSEAR P, HSEAR N and GND					
	XMICN and GND	HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					

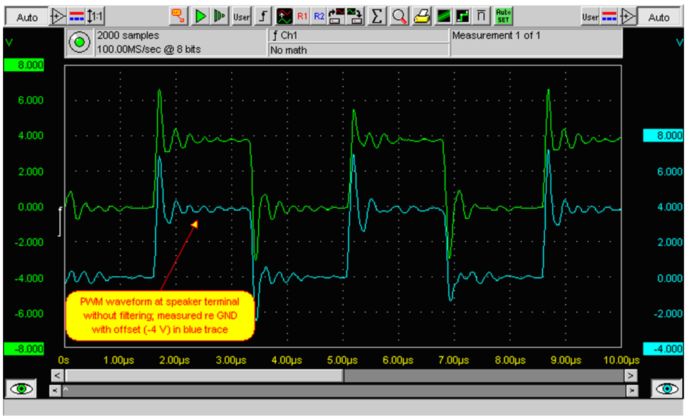
Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to Internal Earpiece	XMICP and GND	EarP and GND	-4.5	1000	600	1.2	NA
		EarN and GND					
	XMICN and GND	EarP and GND					
		EarN and GND					
External Mic to Internal handsfree	XMICP and GND	B2102 pads	-5	1000	560	0	25mA (calc.)
	XMICN and GND	B2102 pads					
Internal Mic to External Earpiece	B2100 (OUT/GND)	HSEAR R P, HSEAR R N and GND	22.7	100	1360	1.2	NA
		HSEAR P, HSEAR N and GND					
		HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					

Measurement data


2.000
User
5000 samples
1.00MS/sec @ 12 bits
ƒ Ch1
No math
Measurement 8 of 8
2.000V
V
1.500
1.375
1.250
1.125
1.000
0.875
0.750
0.625
0.500
0s
250.00µs
500.00µs
750.00µs
1.00ms
1.25ms
1.50ms
1.75ms
2.00ms
2.25ms
2.50ms

Earpiece output measured from both earpiece pads (single-ended).

Figure 44 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.

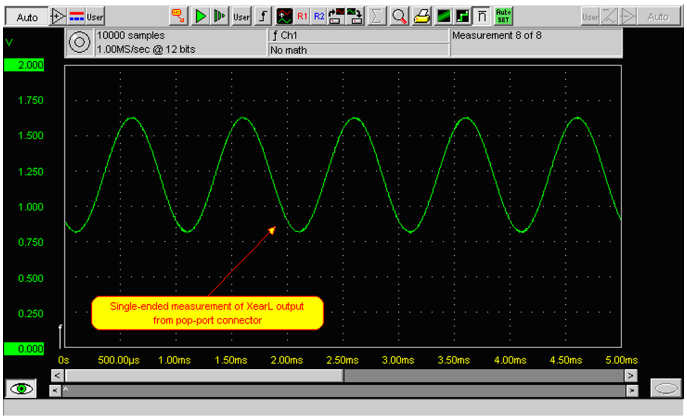


2000 samples
100.00MS/sec @ 8 bits
ƒ Ch1
No math
Measurement 1 of 1

PWM waveform at speaker terminal without filtering; measured re GND with offset (-4 V) in blue trace

Auto
User
R1
R2
Auto SET
User
Auto
V
8.000
6.000
4.000
2.000
0.000
-2.000
-4.000
-6.000
-8.000
V
8.000
6.000
4.000
2.000
0.000
-2.000
-4.000
0s
1.00µs
2.00µs
3.00µs
4.00µs
5.00µs
6.00µs
7.00µs
8.00µs
9.00µs
10.00µs

Figure 45 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected.



10000 samples
1.00MS/sec @ 12 bits
ƒ Ch1
No math
Measurement 8 of 8

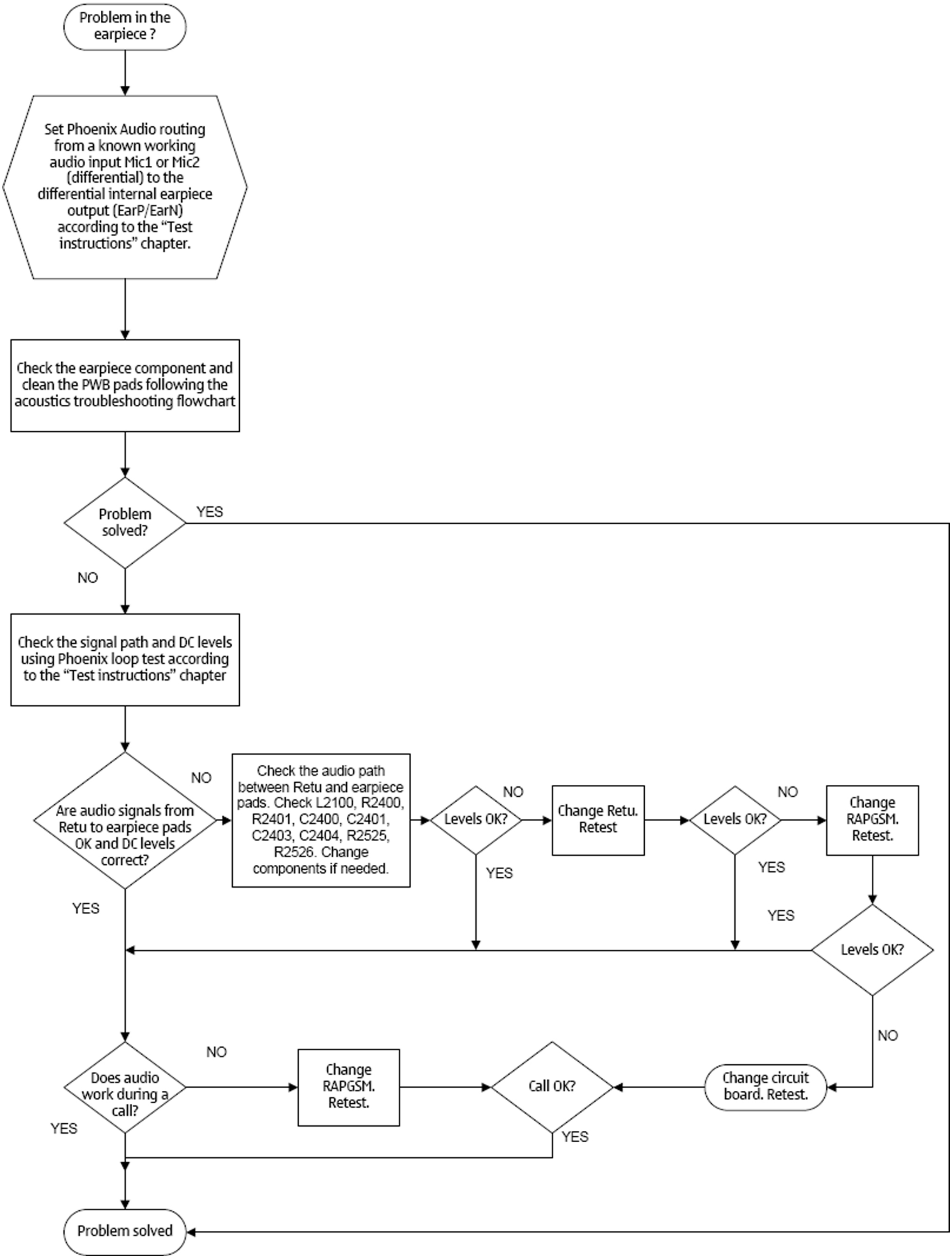
Single-ended measurement of XearL output from pop-port connector

Auto
User
User
R1
R2
Auto SET
User
Auto
V
2.000
1.750
1.500
1.250
1.000
0.750
0.500
0.250
0.000
0s
500.00µs
1.00ms
1.50ms
2.00ms
2.50ms
3.00ms
3.50ms
4.00ms
4.50ms
5.00ms

Figure 46 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.

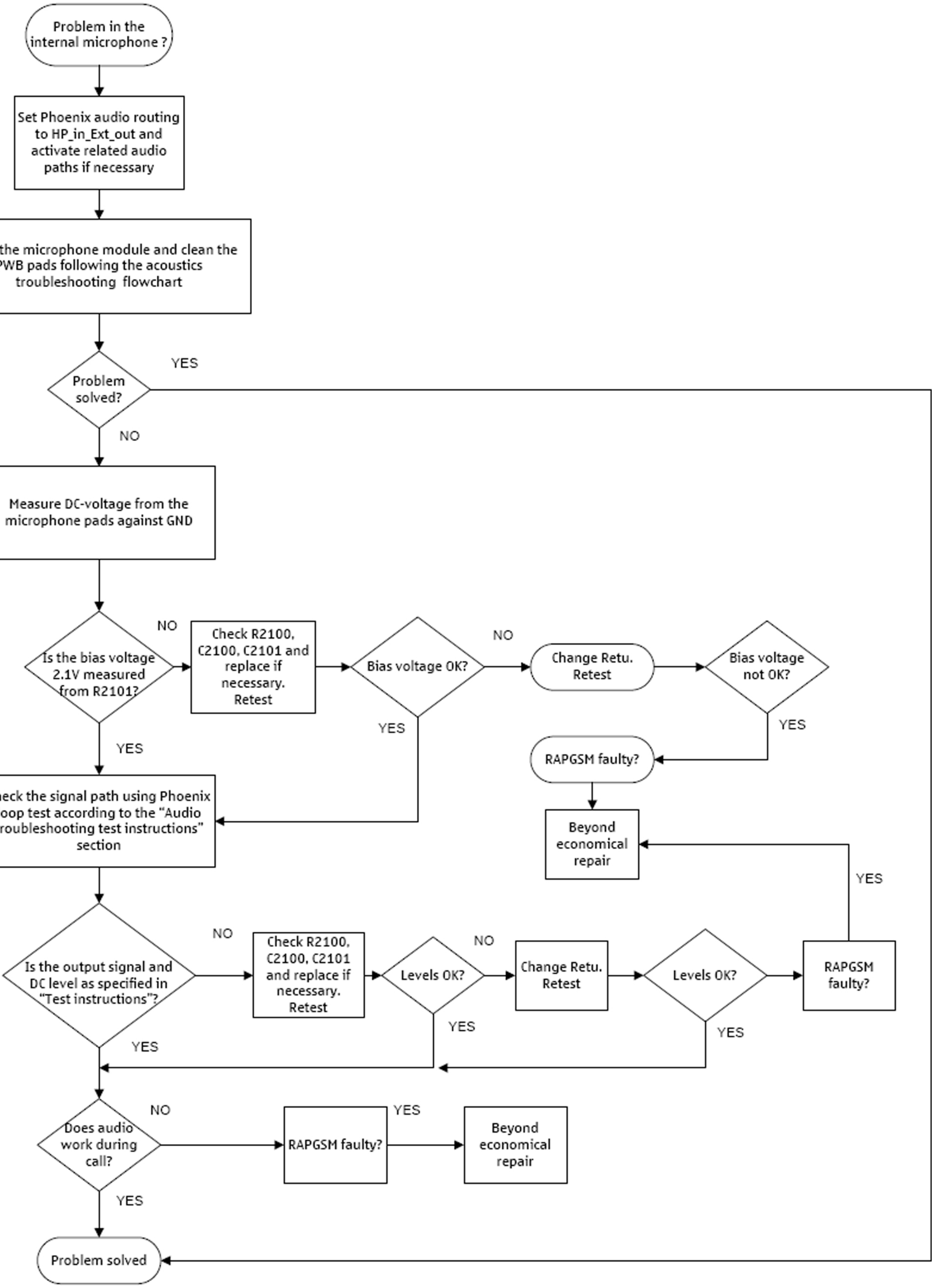
Internal earpiece troubleshooting

Troubleshooting flow


Problem in the earpiece ?
Set Phoenix Audio routing from a known working audio input Mic1 or Mic2 (differential) to the differential internal earpiece output (EarP/EarN) according to the "Test instructions" chapter.
Check the earpiece component and clean the PWB pads following the acoustics troubleshooting flowchart
Problem solved?
YES
NO
Check the signal path and DC levels using Phoenix loop test according to the "Test instructions" chapter
Are audio signals from Retu to earpiece pads OK and DC levels correct?
NO
Check the audio path between Retu and earpiece pads. Check L2100, R2400, R2401, C2400, C2401, C2403, C2404, R2525, R2526. Change components if needed.
Levels OK?
NO
Change Retu. Retest
Levels OK?
NO
Change RAPGSM. Retest.
YES
YES
YES
Levels OK?
YES
NO
Does audio work during a call?
NO
Change RAPGSM. Retest.
Call OK?
Change circuit board. Retest.
YES
YES
Problem solved

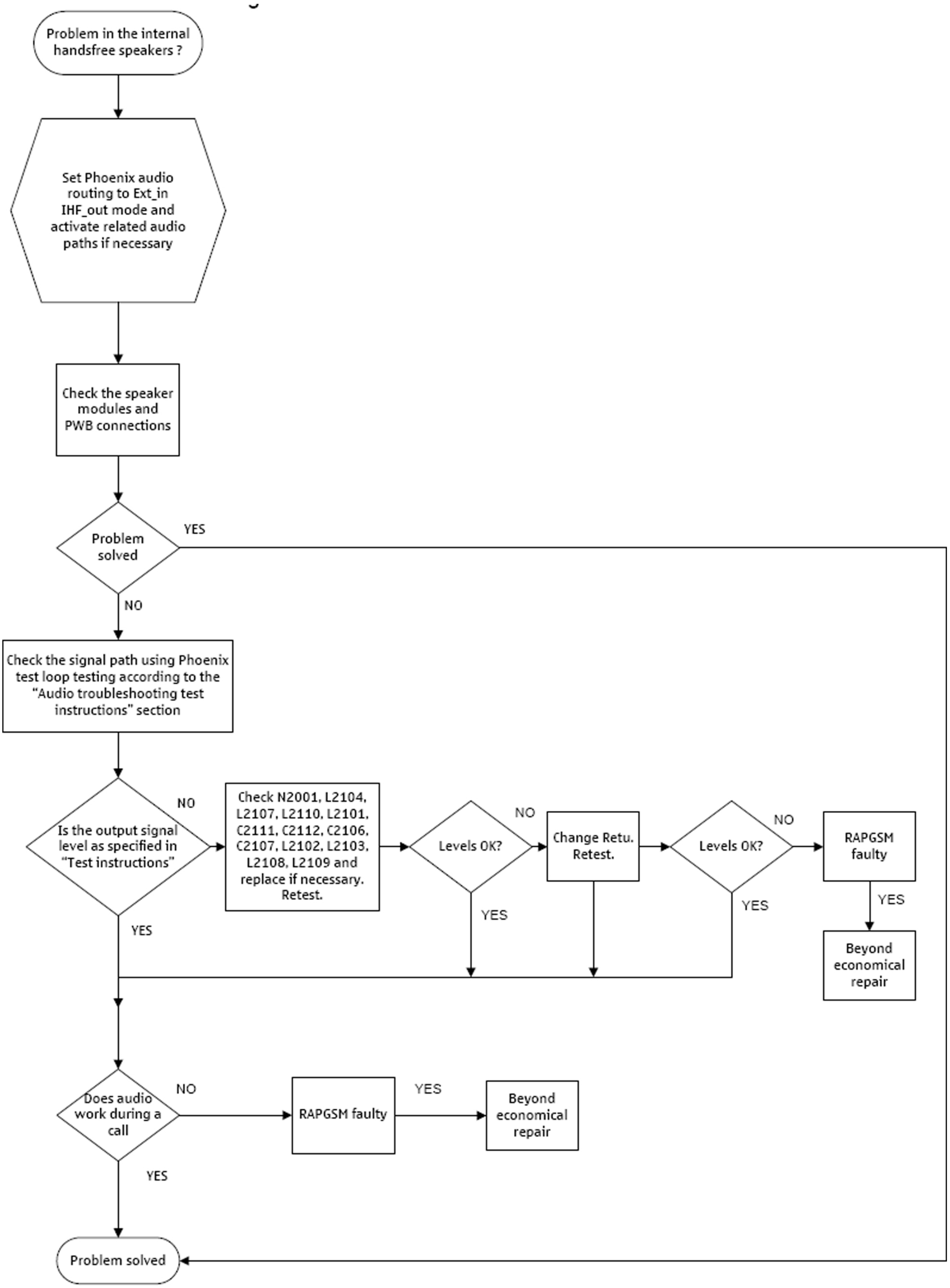
Internal microphone troubleshooting

Troubleshooting flow


Problem in the internal microphone ?
Set Phoenix audio routing to HP_in_Ext_out and activate related audio paths if necessary
Check the microphone module and clean the PWB pads following the acoustics troubleshooting flowchart
Problem solved?
YES
NO
Measure DC-voltage from the microphone pads against GND
Is the bias voltage 2.1V measured from R2101?
NO
Check R2100, C2100, C2101 and replace if necessary. Retest
Bias voltage OK?
NO
Change Retu. Retest
Bias voltage not OK?
YES
YES
RAPGSM faulty?
Beyond economical repair
YES
Check the signal path using Phoenix loop test according to the "Audio troubleshooting test instructions" section
Is the output signal and DC level as specified in "Test instructions"?
NO
Check R2100, C2100, C2101 and replace if necessary. Retest
Levels OK?
NO
Change Retu. Retest
Levels OK?
RAPGSM faulty?
YES
YES
YES
YES
Does audio work during call?
NO
RAPGSM faulty?
YES
Beyond economical repair
YES
Problem solved

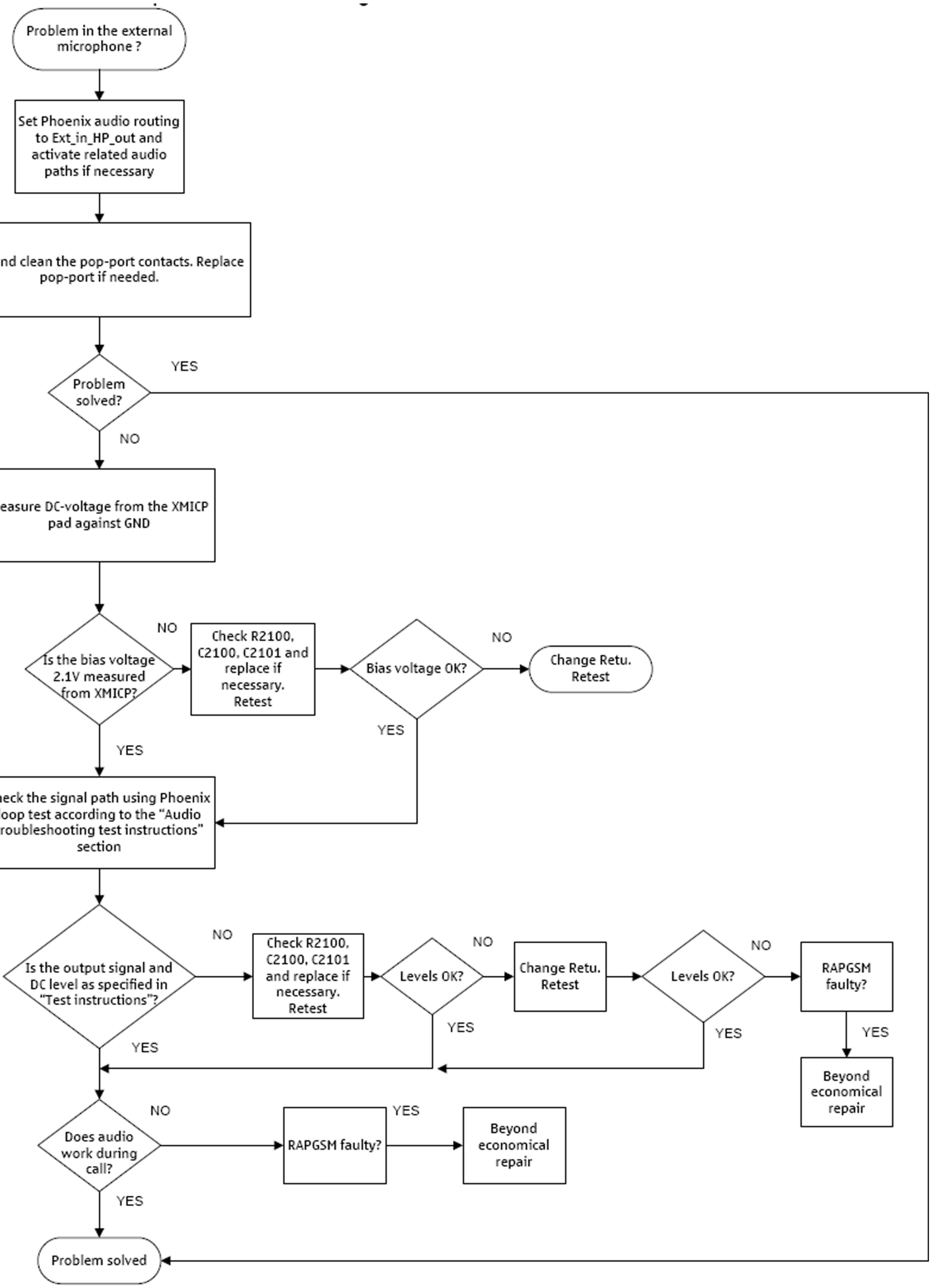
IHF troubleshooting

Troubleshooting flow


Problem in the internal handsfree speakers ?
Set Phoenix audio routing to Ext_in IHF_out mode and activate related audio paths if necessary
Check the speaker modules and PWB connections
Problem solved
YES
NO
Check the signal path using Phoenix test loop testing according to the "Audio troubleshooting test instructions" section
Is the output signal level as specified in "Test instructions"
NO
Check N2001, L2104, L2107, L2110, L2101, C2111, C2112, C2106, C2107, L2102, L2103, L2108, L2109 and replace if necessary. Retest.
Levels OK?
NO
Change Retu. Retest.
Levels OK?
NO
RAPGSM faulty
YES
Beyond economical repair
YES
YES
YES
Does audio work during a call
NO
RAPGSM faulty
YES
Beyond economical repair
YES
Problem solved

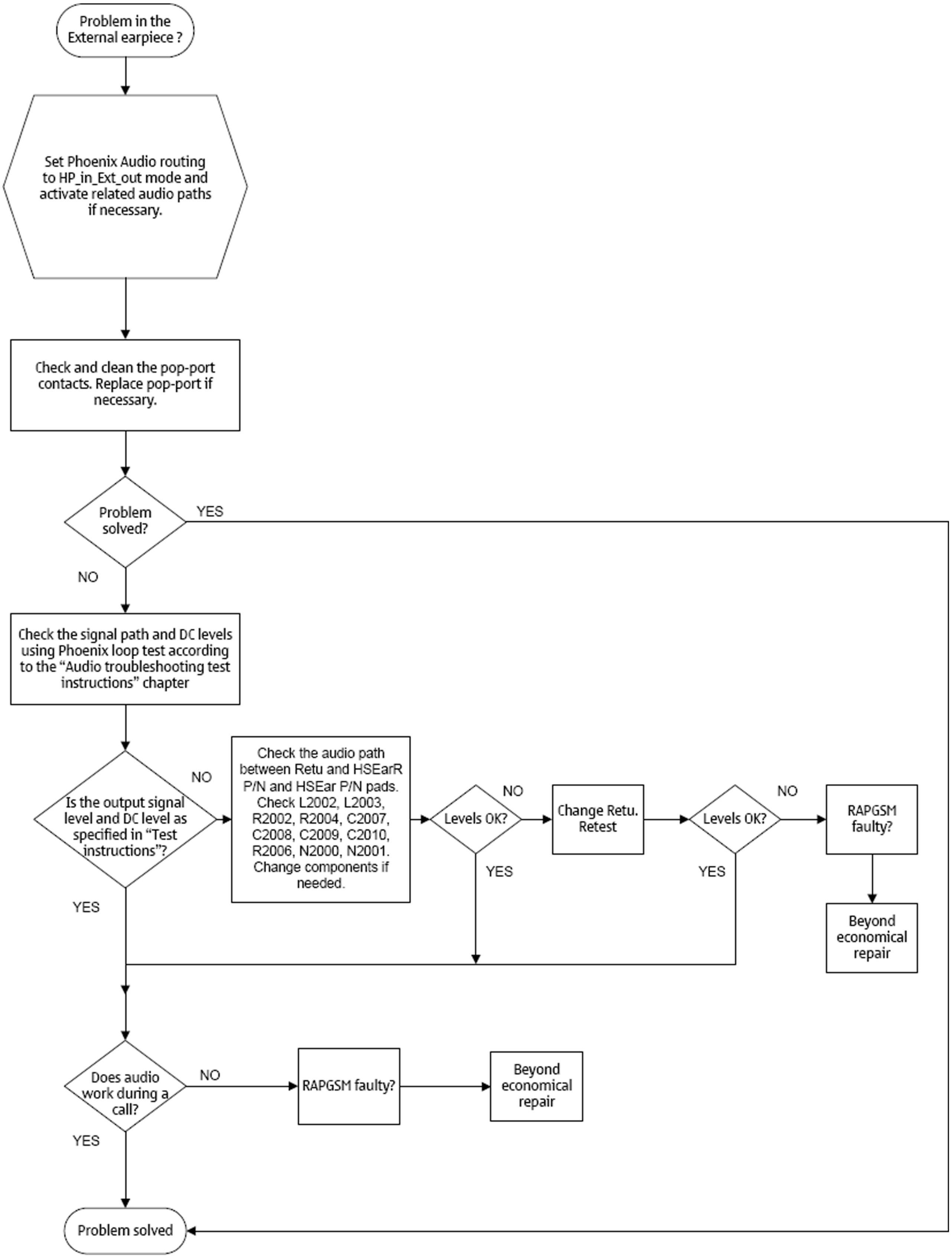
External microphone troubleshooting

Troubleshooting flow


Problem in the external microphone ?
Set Phoenix audio routing to Ext_in_HP_out and activate related audio paths if necessary
Check and clean the pop-port contacts. Replace pop-port if needed.
Problem solved?
YES
NO
Measure DC-voltage from the XMICP pad against GND
Is the bias voltage 2.1V measured from XMICP?
NO
Check R2100, C2100, C2101 and replace if necessary. Retest
Bias voltage OK?
NO
Change Retu. Retest
YES
YES
Check the signal path using Phoenix loop test according to the "Audio troubleshooting test instructions" section
Is the output signal and DC level as specified in "Test instructions"?
NO
Check R2100, C2100, C2101 and replace if necessary. Retest
Levels OK?
NO
Change Retu. Retest
Levels OK?
NO
RAPGSM faulty?
YES
Beyond economical repair
YES
YES
YES
Does audio work during call?
NO
RAPGSM faulty?
YES
Beyond economical repair
YES
Problem solved

External earpiece troubleshooting

Troubleshooting flow


Problem in the External earpiece ?
Set Phoenix Audio routing to HP_in_Ext_out mode and activate related audio paths if necessary.
Check and clean the pop-port contacts. Replace pop-port if necessary.
Problem solved?
YES
NO
Check the signal path and DC levels using Phoenix loop test according to the “Audio troubleshooting test instructions” chapter
Is the output signal level and DC level as specified in “Test instructions”?
NO
YES
Check the audio path between Retu and HSEarR P/N and HSEar P/N pads. Check L2002, L2003, R2002, R2004, C2007, C2008, C2009, C2010, R2006, N2000, N2001. Change components if needed.
Levels OK?
NO
YES
Change Retu. Retest
Levels OK?
NO
YES
RAPGSM faulty?
Beyond economical repair
Does audio work during a call?
NO
YES
RAPGSM faulty?
Beyond economical repair
Problem solved

Introduction to acoustics troubleshooting

Acoustics troubleshooting

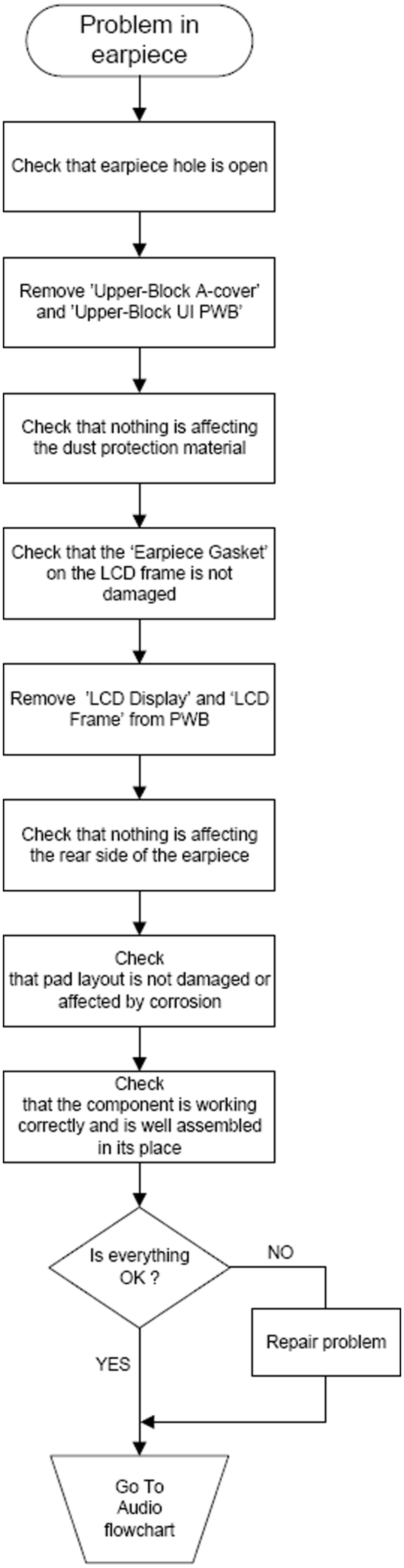
Acoustics design ensures that the sound is detected correctly with a microphone and properly radiated to the outside of the device by speaker(s). The acoustics of the phone includes three basic systems: earpiece, Integrated Hands Free (IHF) and microphone.

The sound reproduced from the earpiece readiates through a single hole on the front cover (A-cover). The sound reproduced from the IHF speakers radiates from left and right sound holes located on both sides of the device. Microphone is located at the bottom, next to the system connector.

For a correct functionality of the phone, all sound holes must be always open. When the phone is used, care must be taken not to close any of those holes with a hand or fingers. The phone should be dry and clean, and no objects must be located in such a way that they close any of the holes.

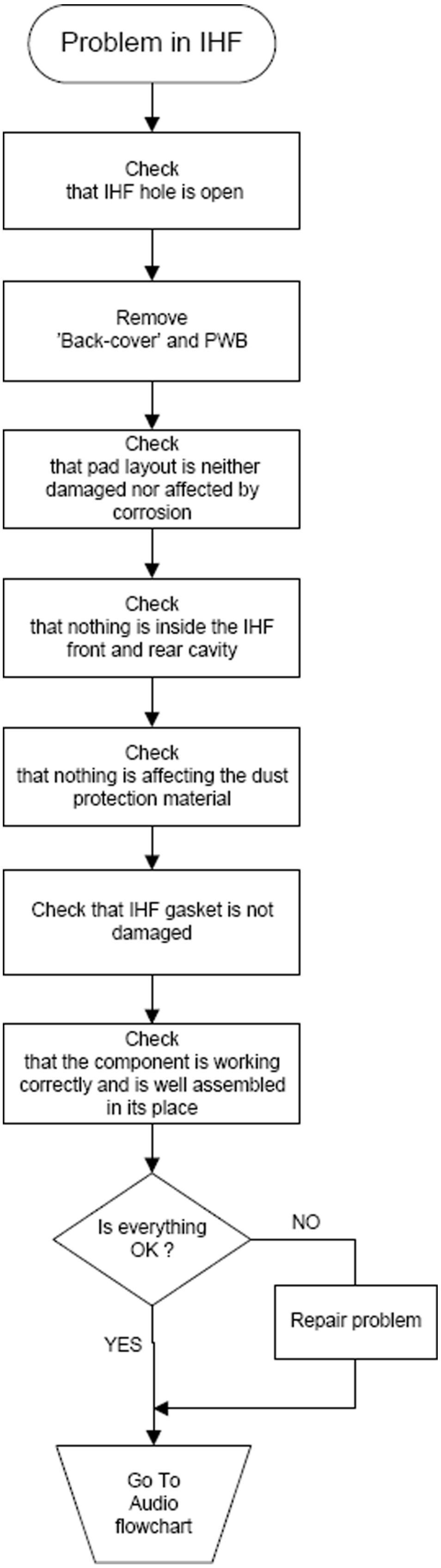
Earpiece troubleshooting

Troubleshooting flow


Problem in earpiece
Check that earpiece hole is open
Remove 'Upper-Block A-cover' and 'Upper-Block UI PWB'
Check that nothing is affecting the dust protection material
Check that the 'Earpiece Gasket' on the LCD frame is not damaged
Remove 'LCD Display' and 'LCD Frame' from PWB
Check that nothing is affecting the rear side of the earpiece
Check that pad layout is not damaged or affected by corrosion
Check that the component is working correctly and is well assembled in its place
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

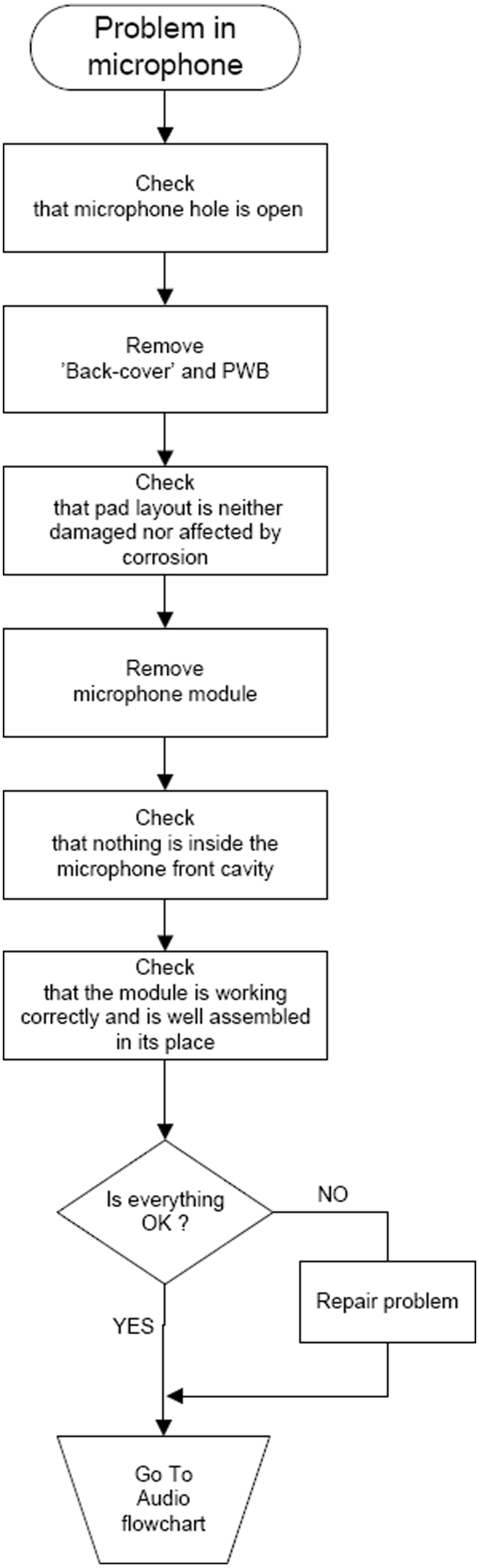
IHF troubleshooting

Troubleshooting flow


Problem in IHF
Check that IHF hole is open
Remove 'Back-cover' and PWB
Check that pad layout is neither damaged nor affected by corrosion
Check that nothing is inside the IHF front and rear cavity
Check that nothing is affecting the dust protection material
Check that IHF gasket is not damaged
Check that the component is working correctly and is well assembled in its place
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

Microphone troubleshooting

Troubleshooting flow


Problem in microphone
Check that microphone hole is open
Remove 'Back-cover' and PWB
Check that pad layout is neither damaged nor affected by corrosion
Remove microphone module
Check that nothing is inside the microphone front cavity
Check that the module is working correctly and is well assembled in its place
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

Baseband manual tuning guide

Energy management calibration

Before you begin

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. Choose **File→ Scan Product.**
4. Choose **Tuning→Energy Management Calibration.**
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

   Note: ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.

8. Click **Calibrate**.

   The calibration of the selected item(s) is carried out automatically.

   The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

Table 9 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-20	20
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
IBAT (ICal) Gain	5750	12250

9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

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7 — RF Troubleshooting and Manual Tuning Guide

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Introduction to RF troubleshooting

All measurements should be done using:

- spectrum analyser with a high-frequency high-impedance passive probe (LO-/reference frequencies and RF power levels)
- oscilloscope with a 10:1 probe (DC-voltages and low frequency signals)

> **Caution:** Also all measurements with an RF coupler should be performed in RF shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use RF shielded environment, it should be checked that there are no transmissions on the same frequencies as used in the tests.

The RF section of the phone is build around one RF ASIC: ASIC N7505.

> **Note:** Before changing N7505, please check the following things: supply voltages and serial communication coming from baseband toN7505 are OK. Please note that the grounding of the Frond End Module (FEM) is directly below FEM so it is difficult to check or change.

Most RF semiconductors are static discharge sensitive! ESD protection must be taken care of during repair (ground straps and ESD soldering irons). N7505 and FEM are moisture sensitive, so parts must be pre-baked prior to soldering.

In addition to key components, there are lot of discrete components (resistors, inductors and capacitors) which troubleshooting is done mainly by checking if the soldering of the component is done properly.

Capacitor can be checked for shorts and resistors for value by means of an ohmmeter, but be aware in-circuit measurements should be evaluated carefully as other components connected to the same node can change the seen resistance.

Keep in mind that all measured voltages or RF levels depicted in the service manual are rough figures. Especially RF levels vary because of different measuring equipment or different grounding of the probe used.

When using an RF probe, use a pair of metallic tweezers to connect the probe ground to the PWB ground as close to the measurement point as possible. If measurements are performed in a product specific module jig, then “GND” pads should be used for the probe ground.

RF key component placement

The RF section of the phone is build around one RF ASIC: ASIC N7505.

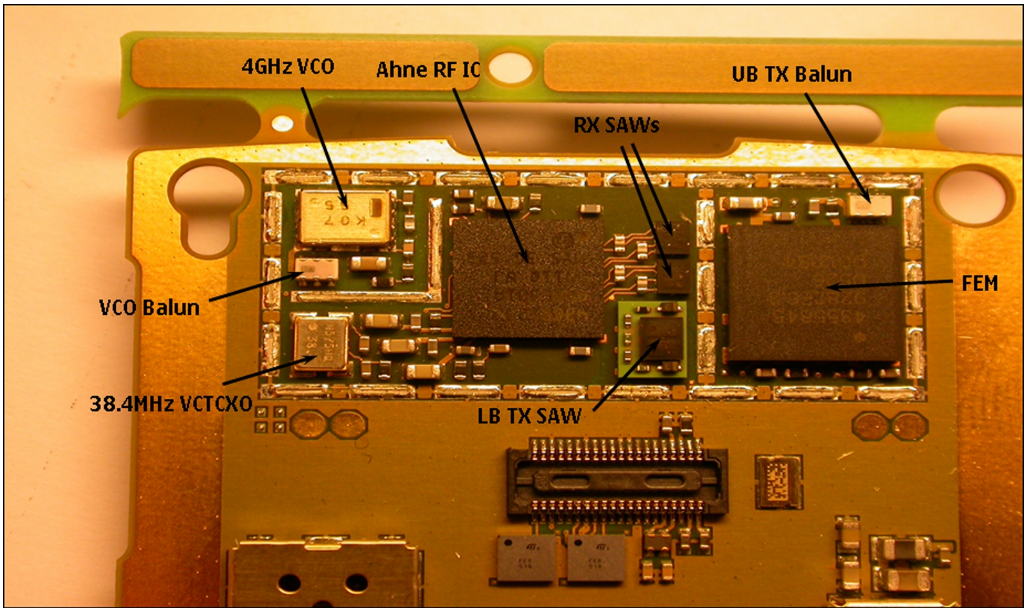

4GHz VCO
Ahne RF IC
UB TX Balun
RX SAWs
FEM
VCO Balun
38.4MHz VCTCXO
LB TX SAW

Figure 47 RM-56 RF component placement (top)

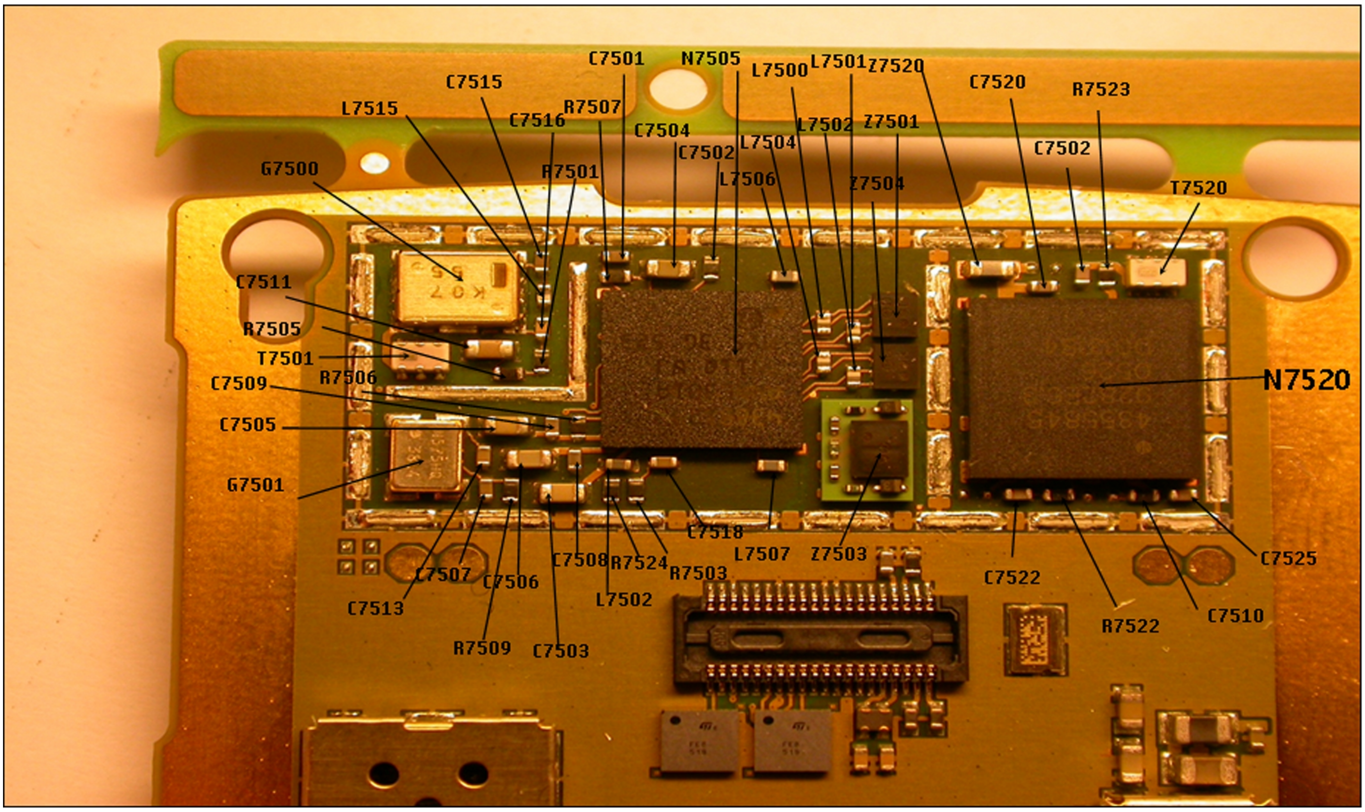

C7501
N7505
L7500
L7501
Z7520
C7515
C7520
R7523
L7515
C7516
R7507
C7504
L7502
Z7501
C7502
L7504
C7502
G7500
R7501
L7506
Z7504
T7520
C7511
R7505
T7501
C7509
R7506
N7520
C7505
G7501
C7518
C7508
R7524
L7507
Z7503
C7525
C7507
C7506
R7503
C7522
C7513
L7502
C7510
R7522
R7509
C7503

Figure 48 RM-56 RF top part components

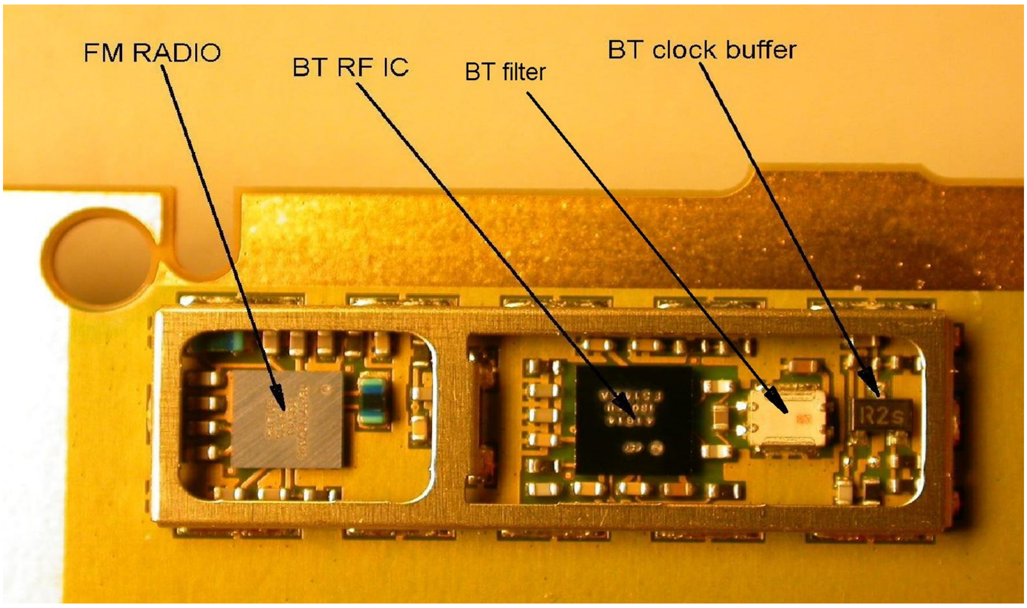

FM RADIO
BT RF IC
BT filter
BT clock buffer

Figure 49 RM-56 FM and BT component placement (top)

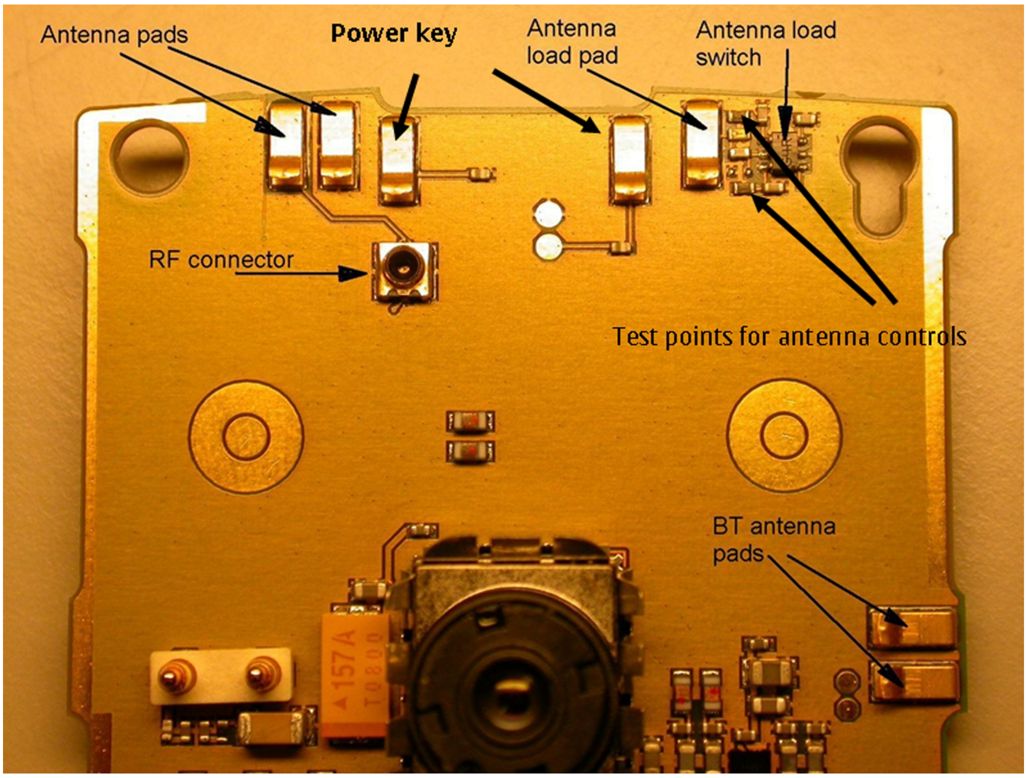

Antenna pads
Power key
Antenna load pad
Antenna load switch
RF connector
Test points for antenna controls
BT antenna pads

Figure 50 RM-56 component placement (bottom)

Receiver troubleshooting

Introduction to RX troubleshooting

Rx can be tested by making a phone call or in the local mode. For the local mode testing, use Phoenix service software.

The main Rx troubleshooting measurement is RSSI measurement. This test measures the signal strength of the received signal. I and Q branches can be measured separately.

In GSM, the input signal can be either a real GSM signal or a CW signal that is 67.771kHz up from the carrier frequency.

For service tool usage instructions, refer to section Service Tools and Service Concepts.

General instructions for RX troubleshooting

Steps

1. Connect a test jig to a computer with a DKU-2 cable or to a FPS-10 flash prommer with a modular cable (XCS-4).

   Make sure that you have a PKD-1 dongle connected to the computer's parallel port.
2. Connect a DC power supply to a module test jig (MJ-69).

   Note: Set the DC supply voltage to 12 V and set the jumper connector on the test jig's **reg.pass** switch to “ON” position.
3. Connect an RF cable between the RF connector of the module test jig (MJ-69) and measurement equipment or alternatively use a 50 ohms (at least 2 W) dummy load in the module test jig RF connector, otherwise GSM may be damaged.

   Note: Make sure that all connections are made to the correct RF connector.
4. Set Rx on.

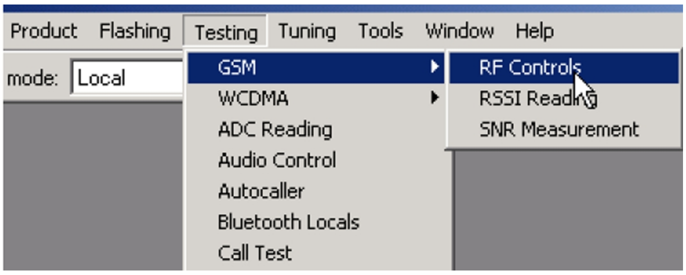
   i Set the phone module to the test jig and start *Phoenix service software*.

   ii Initialize connection to the phone. (With FPS-10 use FBUS driver when using DKU-2 and COMBOX driver).

   iii From the File menu, choose product: **File -> Choose Product -> xx-x*** (* = type designator of the phone, scan product).

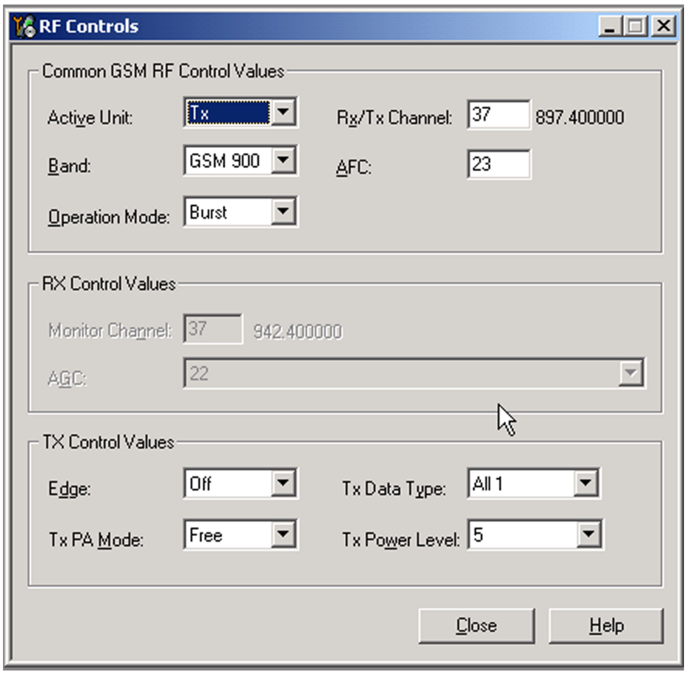
   iv From the toolbar, set operating mode to “Local”.
5. EGSM900, GSM850/1800/1900 troubleshooting

   i From the Testing menu, activate the *RF Controls* window: **Testing -> GSM -> RF Controls** .



   ii In the *RF Controls* window:

   - Select band "GSM850", “GSM900” or “GSM1800” or “GSM1900” (Default = “GSM850”).
   - Set Active unit to “Rx” (Default = “Rx”).
   - Set Operation mode to “Burst” (Default = “Burst”).
   - Set Rx/Tx channel to 190 on GSM850, 37 on GSM900 band or 700 on GSM1800 band or 661 on GSM1900 (Defaults).
   - Set Edge to “Off” (Default). (Not active in RXmode).
   - Set Tx PA mode to “Free” (Default). (Not active in RXmode).
   - Apply 942.46771 MHz (channel 37 + 67.710 kHz offset), 881.66771MHz (channel 190 + 67.710 kHz), 1842.86771 MHz (channel 700 + 67.710 kHz offset) or 1960.06771 MHz (channel 661 + 67.71 kHz) –90 dBm signal to the RF-connector (remember to compensate for cable attenuation).



Common GSM RF Control Values

Active Unit: Tx
Rx/Tx Channel: 37 897.400000
Band: GSM 900
AFC: 23
Operation Mode: Burst

RX Control Values

Monitor Channel: 37 942.400000
AGC: 22

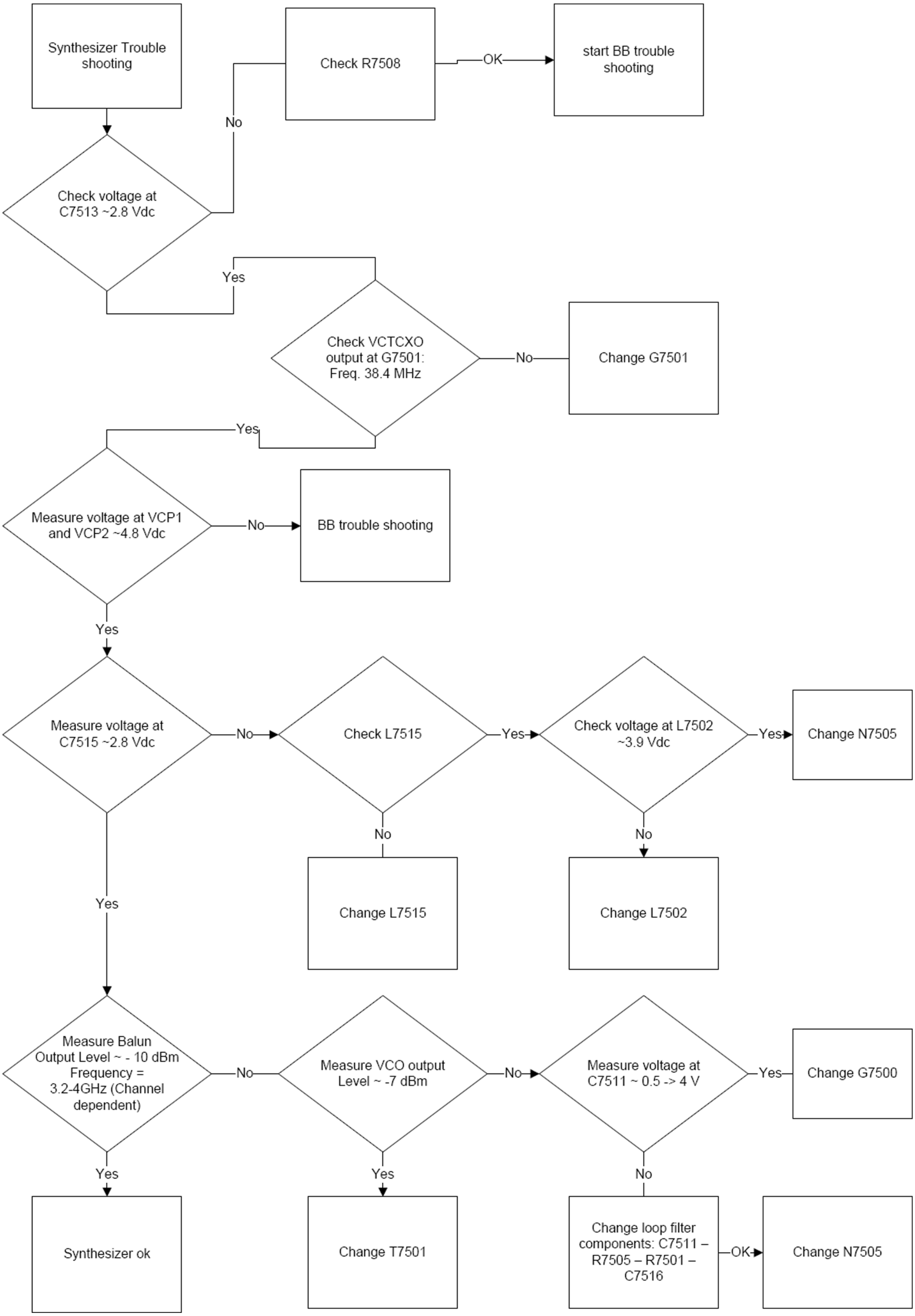
TX Control Values

Edge: Off
Tx Data Type: All 1
Tx PA Mode: Free
Tx Power Level: 5

Figure 51 RF Controls window

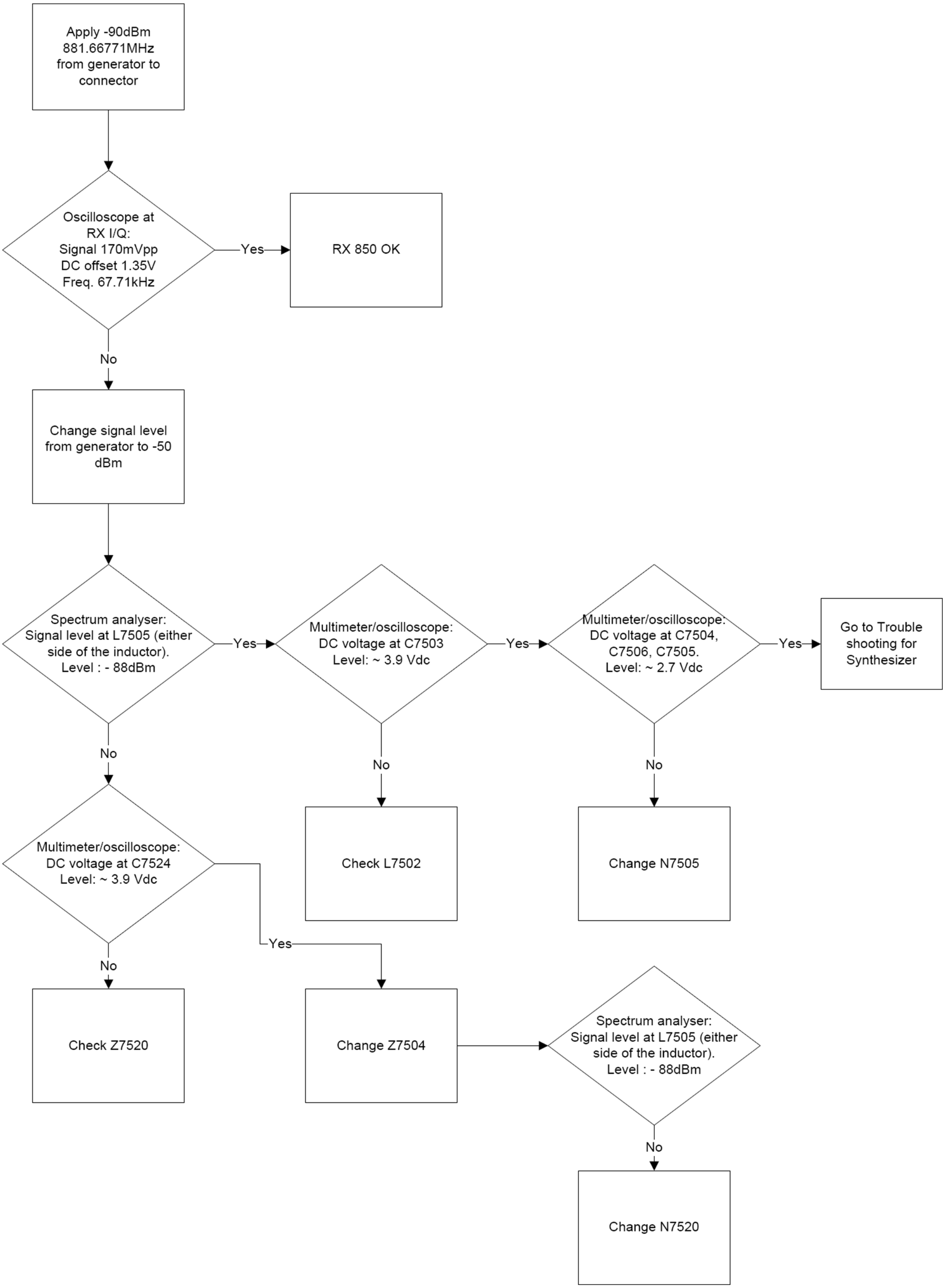
Synthesizer troubleshooting

Troubleshooting flow


Synthesizer Trouble shooting
Check voltage at C7513 ~2.8 Vdc
No
Check R7508
OK
start BB trouble shooting
Yes
Check VCTCXO output at G7501: Freq. 38.4 MHz
No
Change G7501
Yes
Measure voltage at VCP1 and VCP2 ~4.8 Vdc
No
BB trouble shooting
Yes
Measure voltage at C7515 ~2.8 Vdc
No
Check L7515
Yes
Check voltage at L7502 ~3.9 Vdc
Yes
Change N7505
No
Change L7515
No
Change L7502
Yes
Measure Balun Output Level ~ - 10 dBm Frequency = 3.2-4GHz (Channel dependent)
No
Measure VCO output Level ~ -7 dBm
No
Measure voltage at C7511 ~ 0.5 -> 4 V
Yes
Change G7500
Yes
Synthesizer ok
Yes
Change T7501
No
Change loop filter components: C7511 – R7505 – R7501 – C7516
OK
Change N7505

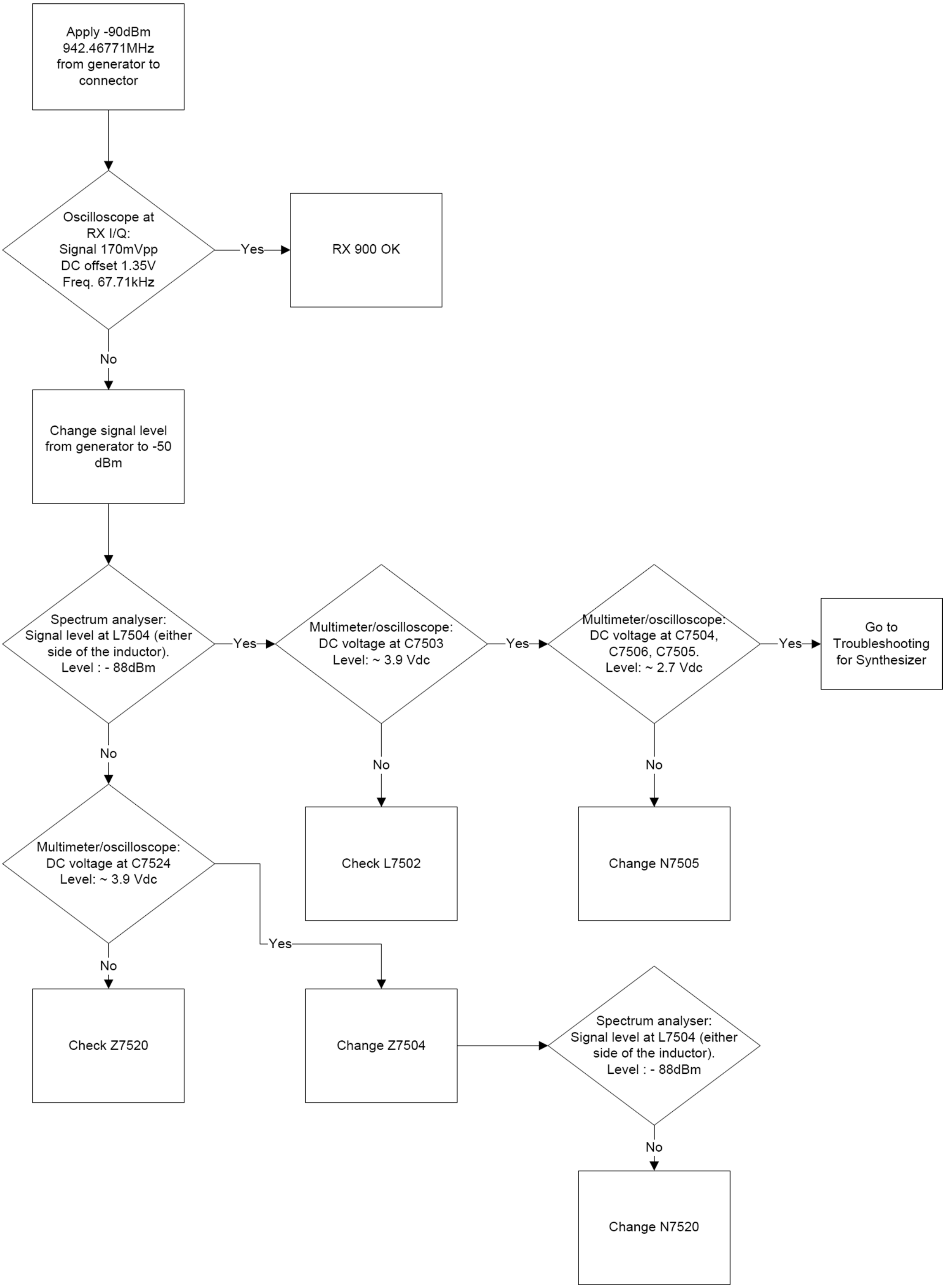
GSM850 troubleshooting

Troubleshooting flow


Apply -90dBm 881.66771MHz from generator to connector
Oscilloscope at RX I/Q: Signal 170mVpp DC offset 1.35V Freq. 67.71kHz
Yes
RX 850 OK
No
Change signal level from generator to -50 dBm
Spectrum analyser: Signal level at L7505 (either side of the inductor). Level : - 88dBm
Yes
Multimeter/oscilloscope: DC voltage at C7503 Level: ~ 3.9 Vdc
Yes
Multimeter/oscilloscope: DC voltage at C7504, C7506, C7505. Level: ~ 2.7 Vdc
Yes
Go to Trouble shooting for Synthesizer
No
No
No
Multimeter/oscilloscope: DC voltage at C7524 Level: ~ 3.9 Vdc
Check L7502
Change N7505
Yes
No
Check Z7520
Change Z7504
Spectrum analyser: Signal level at L7505 (either side of the inductor). Level : - 88dBm
No
Change N7520

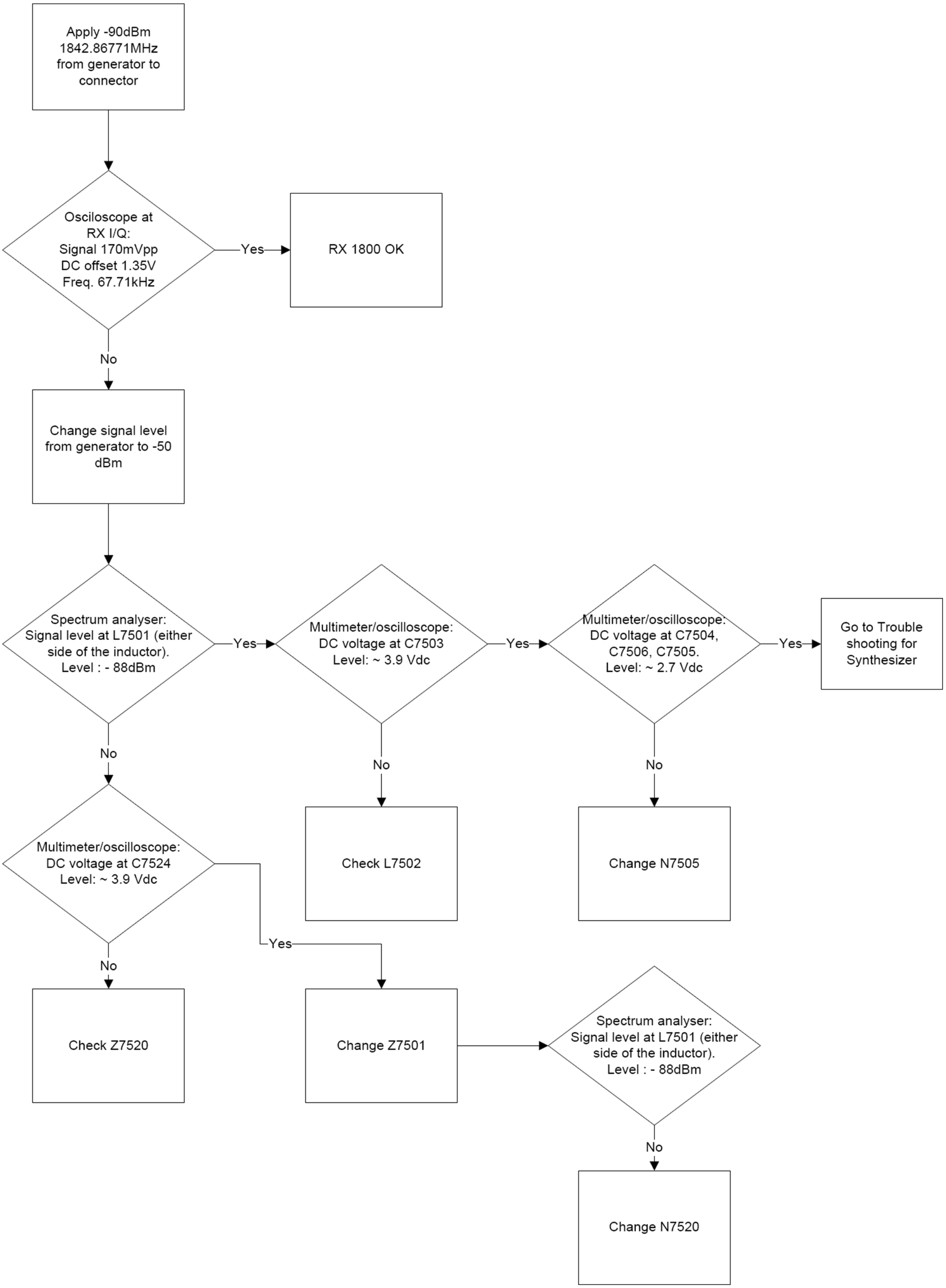
GSM900 troubleshooting

Troubleshooting flow


Apply -90dBm 942.46771MHz from generator to connector
Oscilloscope at RX I/Q: Signal 170mVpp DC offset 1.35V Freq. 67.71kHz
Yes
RX 900 OK
No
Change signal level from generator to -50 dBm
Spectrum analyser: Signal level at L7504 (either side of the inductor). Level : - 88dBm
Yes
Multimeter/oscilloscope: DC voltage at C7503 Level: ~ 3.9 Vdc
Yes
Multimeter/oscilloscope: DC voltage at C7504, C7506, C7505. Level: ~ 2.7 Vdc
Yes
Go to Troubleshooting for Synthesizer
No
No
No
Multimeter/oscilloscope: DC voltage at C7524 Level: ~ 3.9 Vdc
Check L7502
Change N7505
Yes
No
Check Z7520
Change Z7504
Spectrum analyser: Signal level at L7504 (either side of the inductor). Level : - 88dBm
No
Change N7520

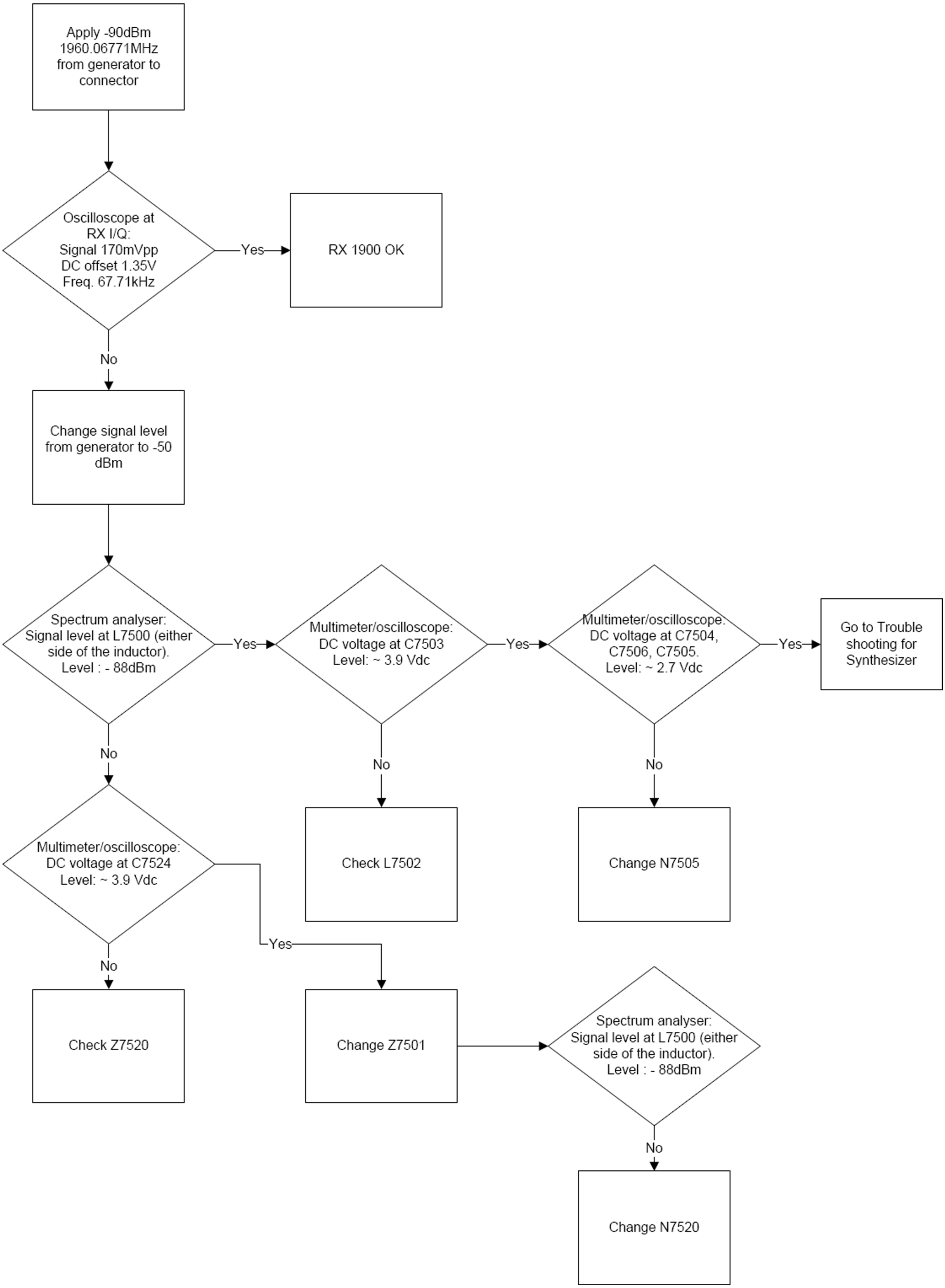
GSM1800 troubleshooting

Troubleshooting flow


Apply -90dBm 1842.86771MHz from generator to connector
Osciloscope at RX I/Q: Signal 170mVpp DC offset 1.35V Freq. 67.71kHz
Yes
RX 1800 OK
No
Change signal level from generator to -50 dBm
Spectrum analyser: Signal level at L7501 (either side of the inductor). Level : - 88dBm
Yes
Multimeter/oscilloscope: DC voltage at C7503 Level: ~ 3.9 Vdc
Yes
Multimeter/oscilloscope: DC voltage at C7504, C7506, C7505. Level: ~ 2.7 Vdc
Yes
Go to Trouble shooting for Synthesizer
No
No
No
Multimeter/oscilloscope: DC voltage at C7524 Level: ~ 3.9 Vdc
Check L7502
Change N7505
Yes
No
Check Z7520
Change Z7501
Spectrum analyser: Signal level at L7501 (either side of the inductor). Level : - 88dBm
No
Change N7520

GSM1900 troubleshooting

Troubleshooting flow


Apply -90dBm 1960.06771MHz from generator to connector
Oscilloscope at RX I/Q: Signal 170mVpp DC offset 1.35V Freq. 67.71kHz
Yes
RX 1900 OK
No
Change signal level from generator to -50 dBm
Spectrum analyser: Signal level at L7500 (either side of the inductor). Level : - 88dBm
Yes
Multimeter/oscilloscope: DC voltage at C7503 Level: ~ 3.9 Vdc
Yes
Multimeter/oscilloscope: DC voltage at C7504, C7506, C7505. Level: ~ 2.7 Vdc
Yes
Go to Trouble shooting for Synthesizer
No
Multimeter/oscilloscope: DC voltage at C7524 Level: ~ 3.9 Vdc
No
Check L7502
No
Change N7505
Yes
No
Check Z7520
Change Z7501
Spectrum analyser: Signal level at L7500 (either side of the inductor). Level : - 88dBm
No
Change N7520

GSM Rx chain activation for manual measurements / GSM RSSI measurement

Context

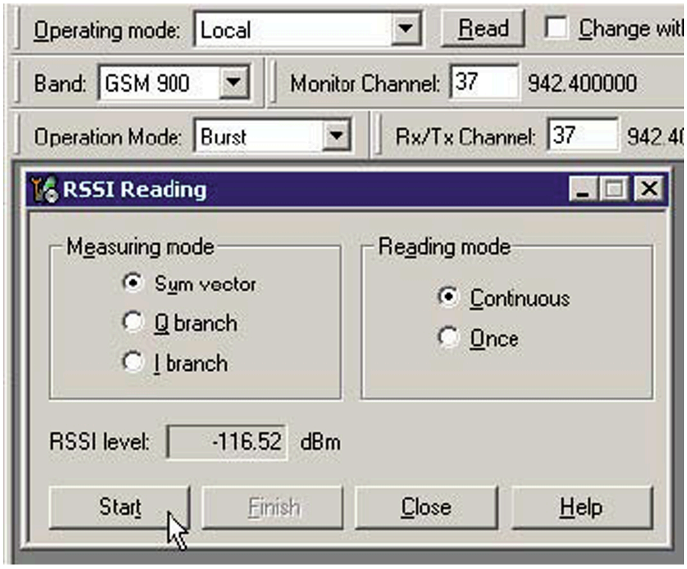
RSSI signal measurement is the main Rx troubleshooting measurement. The test measures the strength of the received signal.

I and Q branches can be measured separately. In GSM, the input signal can be either real GSM signal or a CW (Continuous Wave) signal that is 67.771 kHz above the carrier frequency.

Steps

1. Start *Phoenix* service software.
2. Choose **Testing→GSM→RSSI Reading** .
3. Set the RF signal generator for channel frequency +67.771 kHz CW mode with –90 dBm signal.

   Alternatively set the cellular tester downlink channel to the appropriate channel. Make sure that the tester is set to continuous mode, not to burst mode.
4. In the *RSSI Reading* window, select the appropriate band and channel.



Operating mode: Local
Band: GSM 900
Monitor Channel: 37 942.400000
Operation Mode: Burst
Rx/Tx Channel: 37 942.4

Measuring mode
● Sum vector
○ Q branch
○ I branch

Reading mode
● Continuous
○ Once

RSSI level: -116.52 dBm

Figure 52 ***RSSI Reading*** **window**

5. To start the measurement/activate GSM Rx chain, click **Start**.

Results

RSSI reading values of the selected band and channel are displayed.

Transmitter troubleshooting

General instructions for TX troubleshooting

Context

- Tx troubleshooting requires Tx operation.
- Do not transmit on frequencies that are in use!
- Transmitter can be controlled in the local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is "RF Controls".

- Tx IQ tuning and Tx power tuning can be also used in some cases.
- Remember that retuning is not a fix! Phones are tuned correctly in production.

The first set of steps instructs how to assemble the test setup. This setup is general for all Tx troubleshooting tasks.

Alternative steps provide specific troubleshooting instructions for *Phoenix* service software.

> **Caution:** Never activate the GSM transmitter without a proper antenna load. There should be always 50 ohm load connected to the RF connector (antenna, RF-measurement equipment or at least 2 watts dummy load), otherwise GSM PA may be damaged.

Steps

1. Connect a test jig to a computer with a DKU-2 cable or to a FPS-10 flash prommer with a modular cable (XCS-4).

   Make sure that you have a PKD-1 dongle connected to the computer's parallel port.
2. Connect a DC power supply to a module jig (MJ-69).

   > **Note:** When repairing or tuning a transmitter, use an external DC supply with at least 3 A current capability.
   >
   > Set the DC supply voltage to 12V and set the jumper connector on the test jig's **reg.pass** switch to “ON” position.
3. Connect an RF cable between the RF connector of the module test jig (MJ-69) and measurement equipment or alternatively use a 50 ohms (at least 2 W) dummy load in the module test jig RF connector, otherwise GSM may be damaged.

   > **Note:** There are two antenna connectors in the module jig:
   >
   > - one for GSM
   > - one for Bluetooth
   >
   > Make sure that all connections are made to the correct RF connector.

   Normally a spectrum analyser is used as measurement equipment.

   > **Note:** The maximum input power of a spectrum analyser is +30 dBm.
   >
   > To prevent any damage, it is recommended to use 10 dB attenuator on the spectrum analyzer input.
4. Set Tx on.

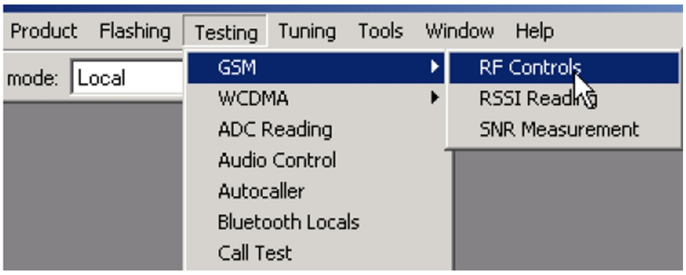
   i Set the phone module to the test jig and start *Phoenix service software*.

   ii Initialize connection to the phone. (With FPS-10 use FBUS driver when using DAU-9S and COMBOX driver).

   iii From the File menu, choose product: **File -> Choose Product -> xx-x*** (* = type designator of the phone).

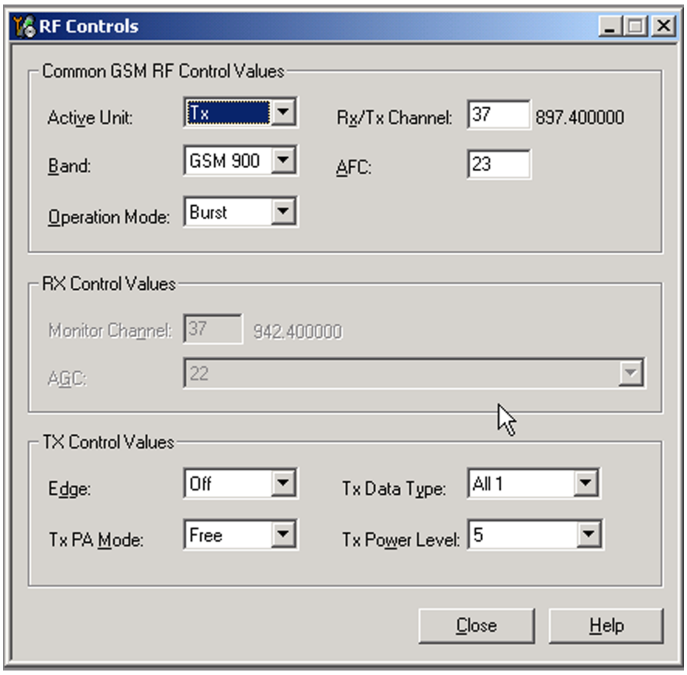
   iv From the toolbar, set operating mode to “Local”.
5. EGSM900, GSM850/1800/1900 troubleshooting

   i From the Testing menu, activate the *RF Controls* window: **Testing -> GSM -> RF Controls** .


Product
Flashing
Testing
Tuning
Tools
Window
Help
mode:
Local
GSM
WCDMA
ADC Reading
Audio Control
Autocaller
Bluetooth Locals
Call Test
RF Controls
RSSI Reading
SNR Measurement

ii In the *RF Controls* window:

- Select band "GSM850", “GSM900” or “GSM1800” or “GSM1900” (Default = “GSM850”).
- Set Active unit to “Tx” (Default = “Rx”).
- Set Operation mode to “Burst” (Default = “Burst”).
- Set Tx data type to “Random” (Default = “All1”).
- Set Rx/Tx channel to 190 on GSM850, 37 on GSM900 band or 700 on GSM1800 band or 661 on GSM1900 (Defaults).
- Set Edge to “Off” (Default).
- Set Tx PA mode to “Free” (Default).
- Set power level to 5 (Default = 19) on GSM850/900 or to 0 (Default = 15) on GSM1800 or GSM1900.


RF Controls

Common GSM RF Control Values
Active Unit: Tx
Band: GSM 900
Operation Mode: Burst
Rx/Tx Channel: 37 897.400000
AFC: 23

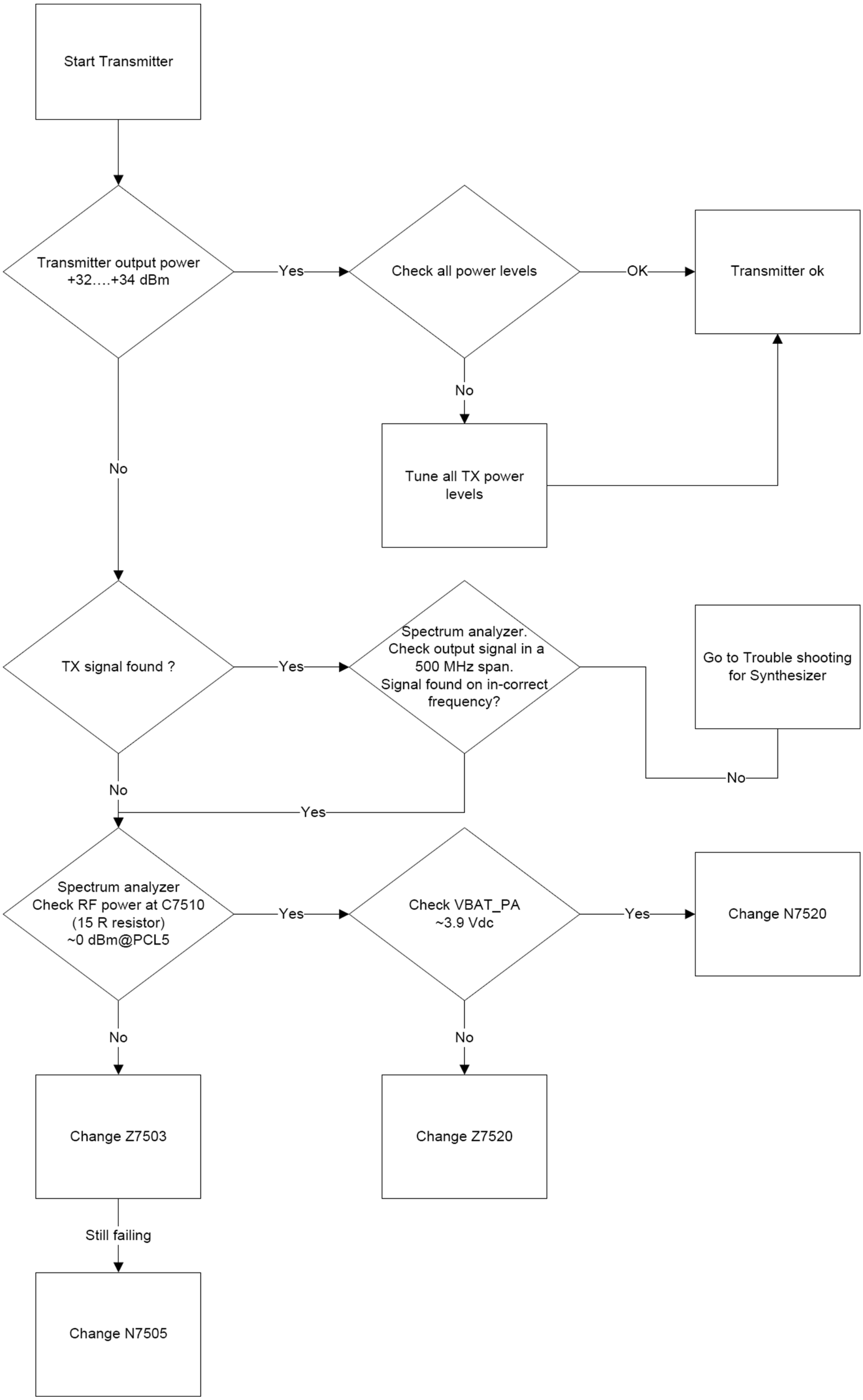
RX Control Values
Monitor Channel: 37 942.400000
AGC: 22

TX Control Values
Edge: Off
Tx PA Mode: Free
Tx Data Type: All 1
Tx Power Level: 5

Figure 53 RF Controls window

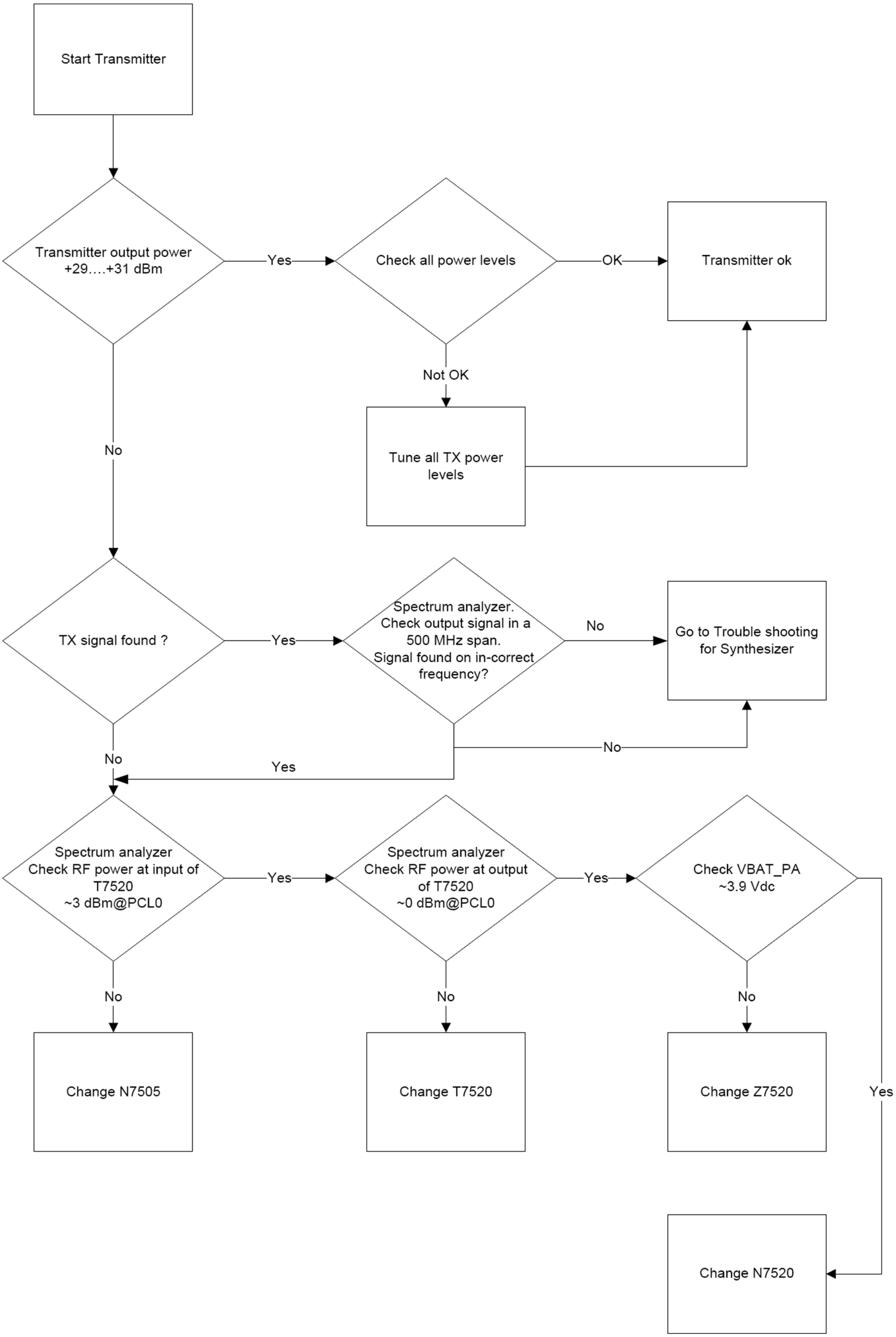
TX 850/900 troubleshooting

Troubleshooting flow


Start Transmitter
Transmitter output power +32….+34 dBm
Yes
Check all power levels
OK
Transmitter ok
No
Tune all TX power levels
No
TX signal found ?
Yes
Spectrum analyzer. Check output signal in a 500 MHz span. Signal found on in-correct frequency?
Go to Trouble shooting for Synthesizer
No
No
Yes
Spectrum analyzer Check RF power at C7510 (15 R resistor) ~0 dBm@PCL5
Yes
Check VBAT_PA ~3.9 Vdc
Yes
Change N7520
No
No
Change Z7503
Change Z7520
Still failing
Change N7505

TX 1800/1900 troubleshooting

Troubleshooting flow


Start Transmitter
Transmitter output power +29….+31 dBm
Yes
Check all power levels
OK
Transmitter ok
Not OK
Tune all TX power levels
No
TX signal found ?
Yes
Spectrum analyzer. Check output signal in a 500 MHz span. Signal found on in-correct frequency?
No
Go to Trouble shooting for Synthesizer
No
No
Yes
Spectrum analyzer Check RF power at input of T7520 ~3 dBm@PCL0
Yes
Spectrum analyzer Check RF power at output of T7520 ~0 dBm@PCL0
Yes
Check VBAT_PA ~3.9 Vdc
No
No
No
Change N7505
Change T7520
Change Z7520
Yes
Change N7520

Checking antenna functionality

The main antenna has one antenna: GSM .

In the GSM antenna, there is one Feed and two GND contacts.

The contacts of the GSM antenna are separated in the (RDC = 0 ohm) short-circuit.

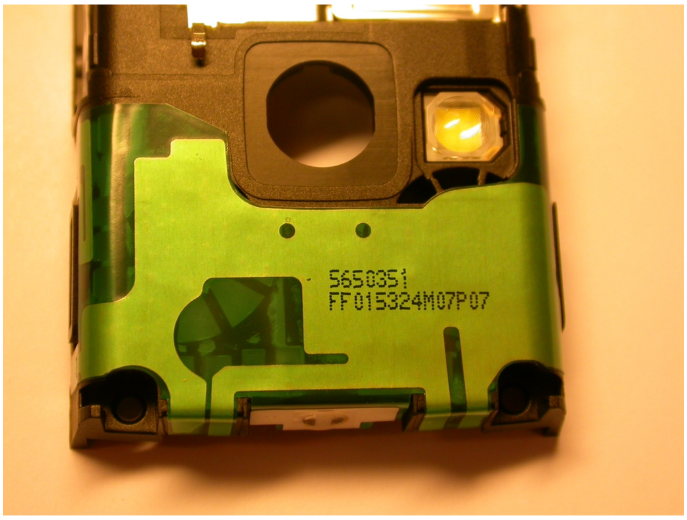


Figure 54 Main antenna

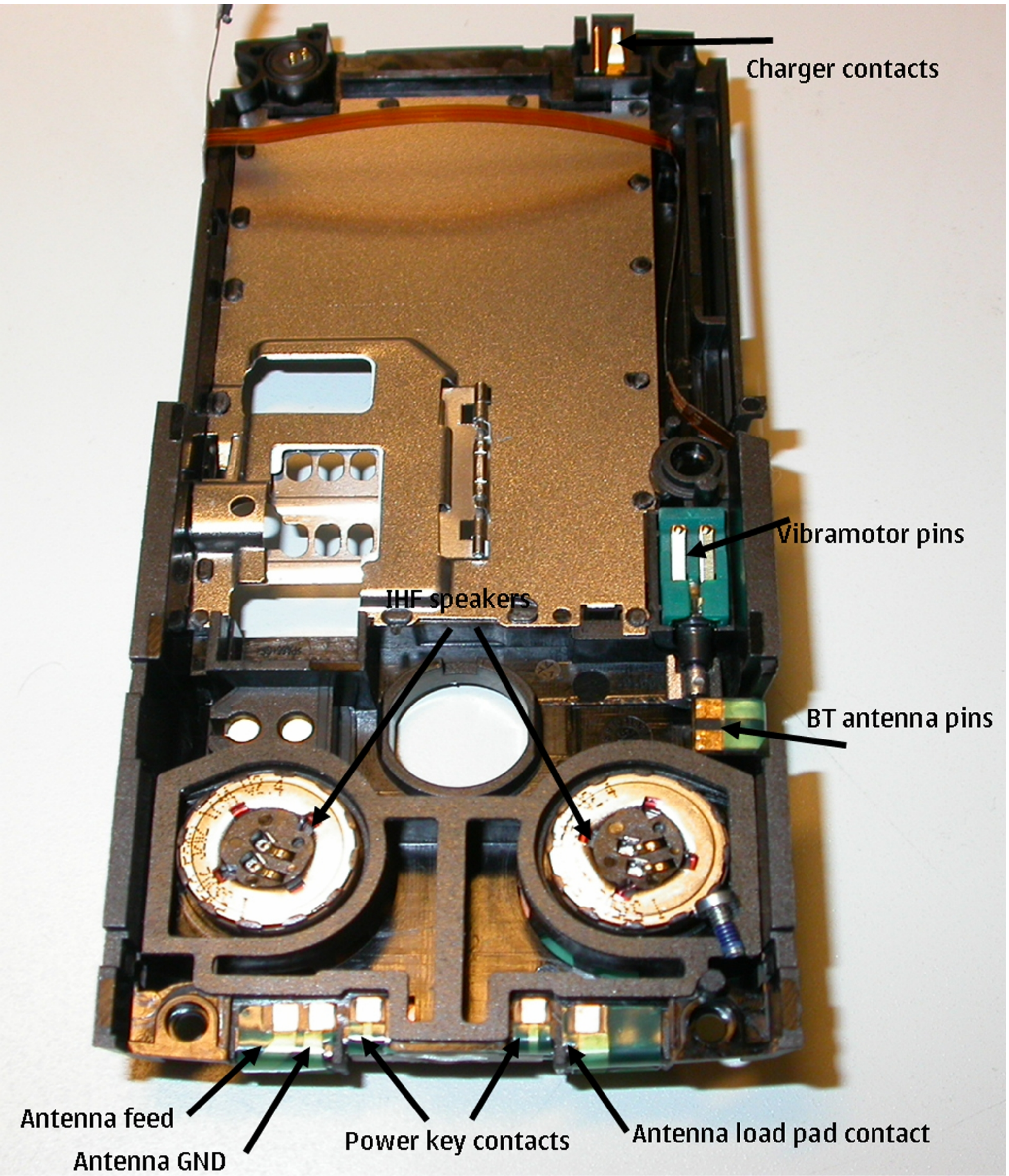

Charger contacts
Vibramotor pins
IHF speakers
BT antenna pins
Antenna feed
Antenna GND
Power key contacts
Antenna load pad contact

Figure 55 Feed and GND spots of the main antenna

The antenna is functioning normally when the contacts function (RDC = 0 ohm) and the antenna is visually intact.

BT antenna

BT antenna has one Feed and one GND contact. The antenna is functioning normally when the contacts function (RDC = 0 ohm) and the antenna is visually intact.

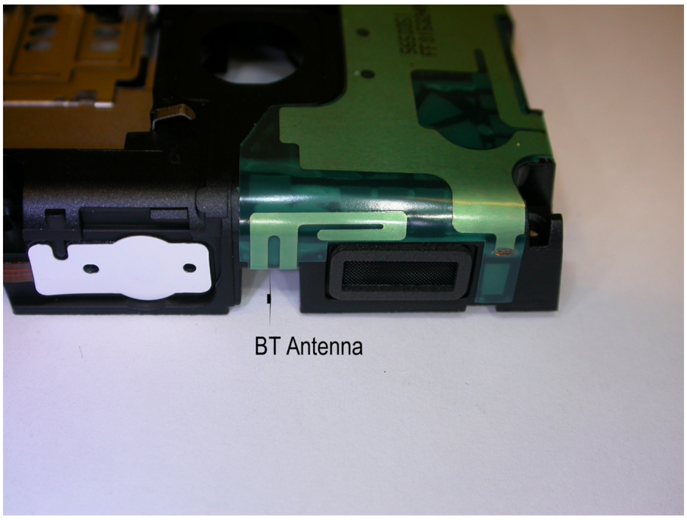


Figure 56 BT antenna

RF tunings

Introduction to RF tunings

Important: Only perform RF tunings if:

- one or more of the RF components is changed
- flash Memory chip is changed or otherwise corrupted.

RF calibration is always performed with the help of a product-specific module jig, never with an RF coupler. Using an RF coupler in the calibration phase will cause a complete mistuning of the RF side.

Important: After RF component changes, **always** use autotuning. Manual tunings are only required in rare cases.

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken in account when the phone is tuned. As all the RF losses are frequency dependent, the user have to be very careful and understand the measurement setup. In the following table there are RF attenuations of the module jig:

Band	Attenuation
GSM850	0.2 dB
GSM900	0.2 dB
GSM1800	0.3 dB
GSM1900	0.3 dB

RF autotuning

Before you begin

For information on the recommended test set-up, refer to the corresponding information on PWS/NOL.

Before you can use the auto-tune feature, the GPIB driver from the GPIB card vendor must be installed and running.

The autotune **.ini** file must be in a correct place: **C:\Program Files\Nokia\Phoenix\products\xx-x*\autotune_xx-x*.ini** (**= indicates the type designator of the phone, e.g. RM-1*)

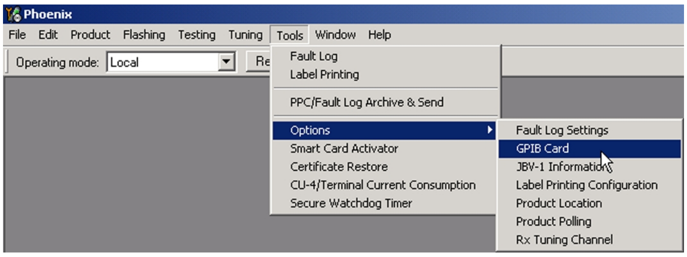
Context

RF autotuning is performed with the aid of Digital Radio Communication Tester. Autotuning covers all RF tunings that are needed to perform after RF component repairs.

> **Note:** Do not perform RF autotuning without a proper reason. Phones are tuned in production and an RF tuning may be performed only after component repairs or if the RF tuning information is lost.

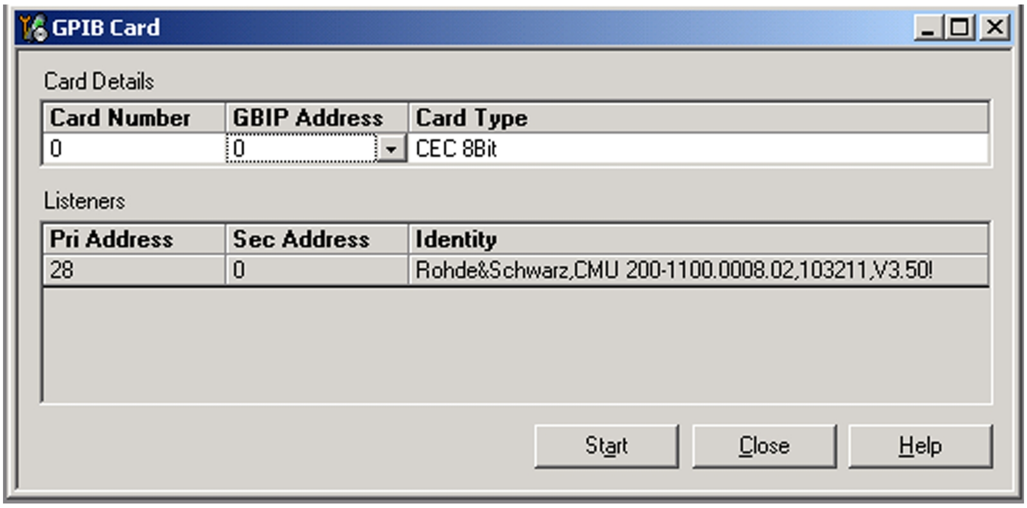
Steps

1. Connect the communication tester to the GPIB bus.
2. Start Phoenix service software.
3. From the Tools menu, choose Options -> GPIB Card.


Phoenix
File
Edit
Product
Flashing
Testing
Tuning
Tools
Window
Help
Operating mode: Local
Fault Log
Label Printing
PPC/Fault Log Archive & Send
Options
Smart Card Activator
Certificate Restore
CU-4/Terminal Current Consumption
Secure Watchdog Timer
Fault Log Settings
GPIB Card
JBV-1 Information
Label Printing Configuration
Product Location
Product Polling
Rx Tuning Channel

4. In the Card Type line, select CEC8Bit, then click Start.

   After clicking Start, the name of the communication tester appears in the list of found Listeners.


GPIB Card
Start
Close
Help

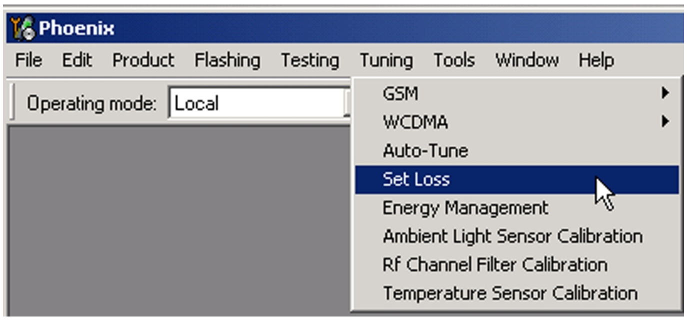
Card Details

Card Number	GBIP Address	Card Type
0	0	CEC 8Bit

Listeners

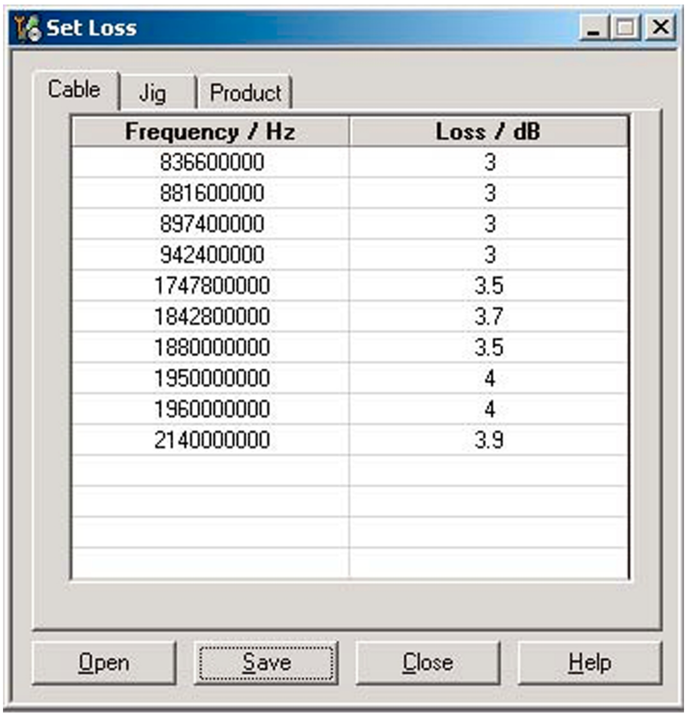
Pri Address	Sec Address	Identity
28	0	Rohde&Schwarz,CMU 200-1100.0008.02,103211,V3.50!

5. To specify the cable loss from module jig to the communication tester, choose "Set Loss" from the Tuning menu.


Phoenix
File
Edit
Product
Flashing
Testing
Tuning
Tools
Window
Help
Operating mode: Local
GSM
WCDMA
Auto-Tune
Set Loss
Energy Management
Ambient Light Sensor Calibration
RF Channel Filter Calibration
Temperature Sensor Calibration

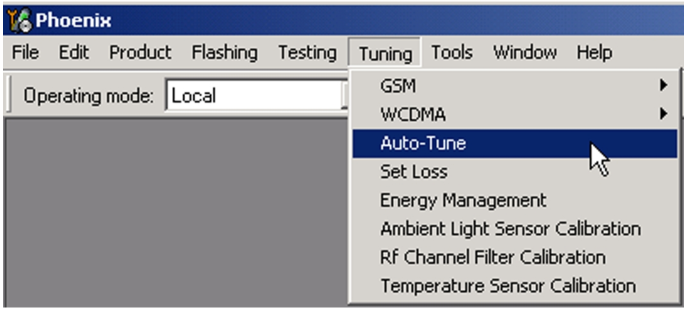
6. Click the Cable tab and add the extra cable attenuation.

Note: Cable losses have to be determined on the basis of a cable used.

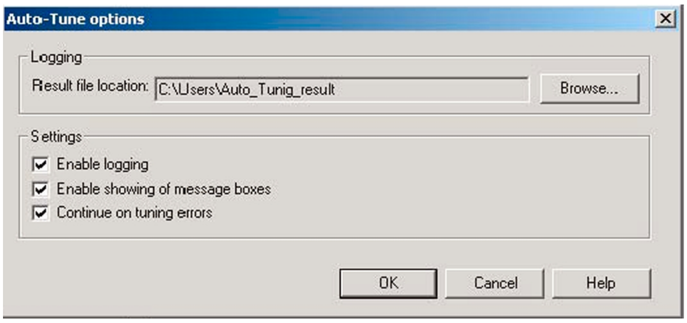

Set Loss
Cable
Jig
Product
Open
Save
Close
Help

Frequency / Hz	Loss / dB
836600000	3
881600000	3
897400000	3
942400000	3
1747800000	3.5
1842800000	3.7
1880000000	3.5
1950000000	4
1960000000	4
2140000000	3.9

7. To start autotuning, choose Auto-Tune from the Tuning menu.


Phoenix
File
Edit
Product
Flashing
Testing
Tuning
Tools
Window
Help
Operating mode:
Local
GSM
WCDMA
Auto-Tune
Set Loss
Energy Management
Ambient Light Sensor Calibration
Rf Channel Filter Calibration
Temperature Sensor Calibration

8. In the Auto-Tune window, click Options.
9. In the Auto-Tune options window, see that the "Enable showing of messages" check box is checked, then click OK.


Auto-Tune options
Logging
Browse...
Settings
OK
Cancel
Help

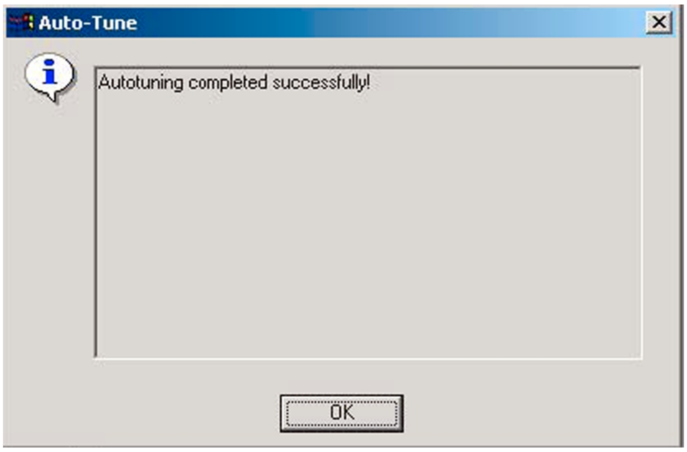
Result file location: C:\Users\Auto_Tunig_result

☑ Enable logging
☑ Enable showing of message boxes
☑ Continue on tuning errors

10. To complete the RF autotuning, click OK.

Results

"Autotuning completed successfully" message appears.



Autotuning completed successfully!

System mode independent manual tunings

Rf channel filter calibration

Context

Rf channel filter calibration tunes the internal low pass filters of Rx and Tx ASICs that limit the bandwidth of BB IQ signals.

One common calibration is made for GSM.

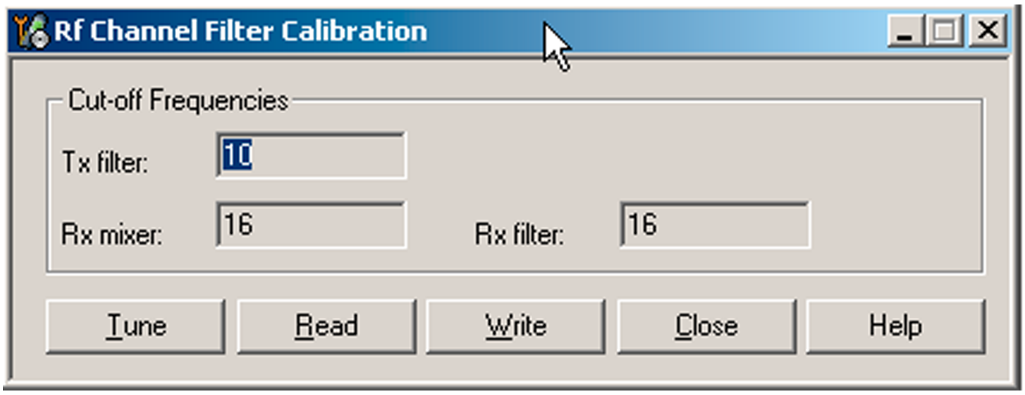
Table 10 Rf channel filter calibration tuning limits

	Min	Typ	Max
Tx filter	0	10	31
Rx filter	0	16	31

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→Rf Channel Filter Calibration** .
3. Click **Tune**.
4. To save the values to the PMM (Phone Permanent Memory) area, click **Write**.
5. To close the *Rf Channel Filter Calibration* window, click **Close**.

Results



Tx filter: 10

Rx mixer: 16

Rx filter: 16

Figure 57 Rf channel filter calibration typical values

PA (power amplifier) detection

Context

The PA detection procedure detects which PA manufacturer is used for phone PAs.

If a PA is changed or if the permanent memory (PMM) data is corrupted, PA detection has to be performed before Tx tunings.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→PA Detection** .
3. Click **Tune**.
4. Check that the detected PA manufacturers are corresponding to the actual chips on the board.
5. To end the procedure, click **Close**.

Temperature sensor calibration

Context

There is a temperature sensor integrated into one of the device ASICs. The ASIC provides DC-voltage, which is temperature dependent.

Temperature sensor calibration is done in room temperature, in which offset caused by the ASIC variation and AD-converter are nullified.

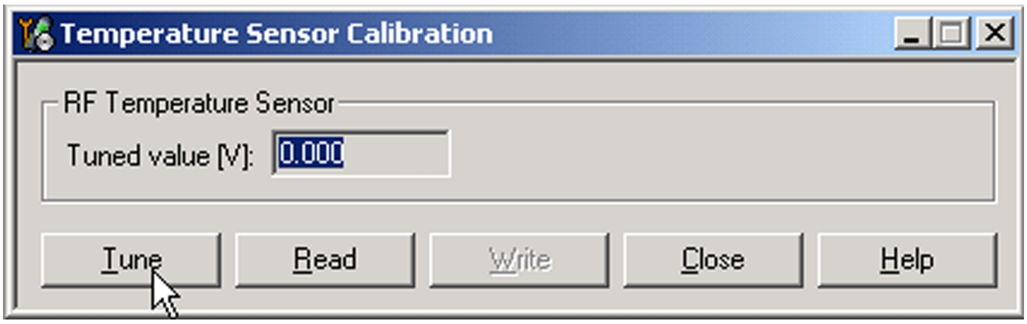
The module is able to do this calibration by itself, no external equipment is needed.

The temperature of the module and components must be 23 +/-2 degrees.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→Temperature Sensor Calibration** .

3. Click **Tune**.



Tuned value [V]: 0.000

Table 11 Temperature sensor calibration tuning limits

Min	Typ	Max	Unit
-20	-4	20	V

4. To save the calibration values, click **Write**.
5. To finish the calibration, click **Close**.

GSM receiver tunings

Rx calibration (GSM)

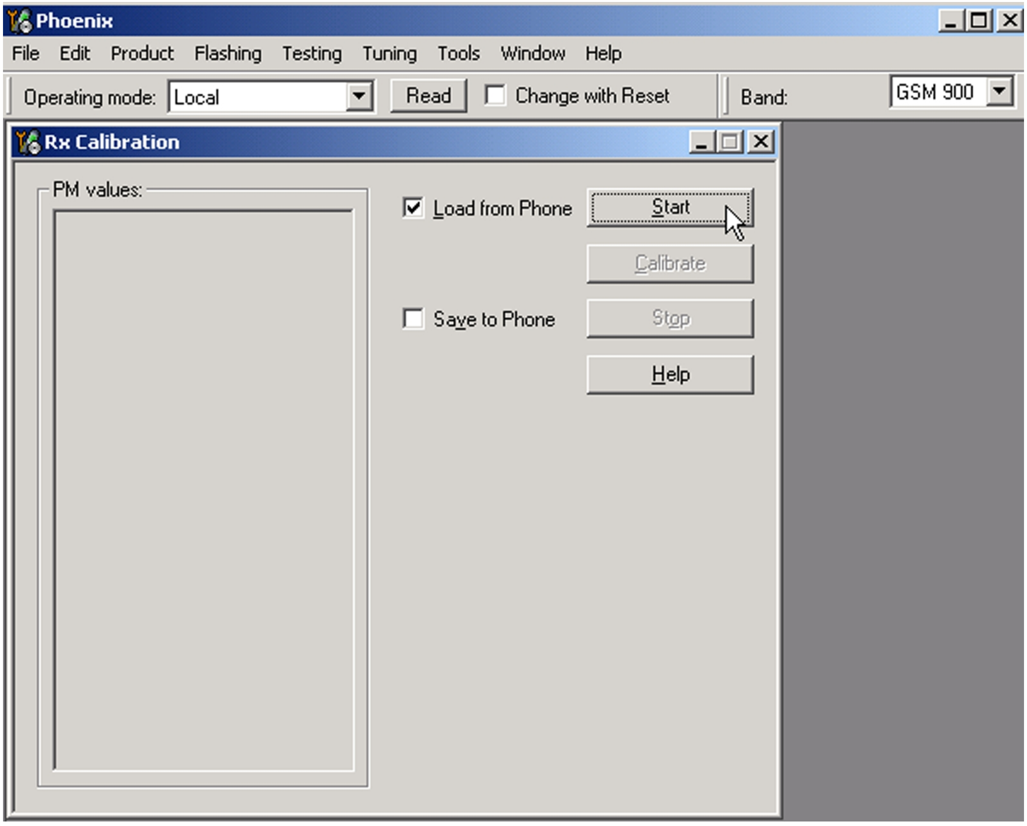
Context

Rx Calibration is used to find out the real gain values of the GSM Rx AGC system and tuning response of the AFC system (AFC D/A init value and AFC slope)

Steps

1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→GSM→Rx Calibration** .
5. Check the **Load from Phone** check box, and uncheck **Save to Phone**.
6. From the **Band** drop-down menu, choose e.g. **GSM900**.

7. Click **Start**.


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Read
Band:
Rx Calibration
PM values:
Start
Calibrate
Stop
Help

Operating mode: Local

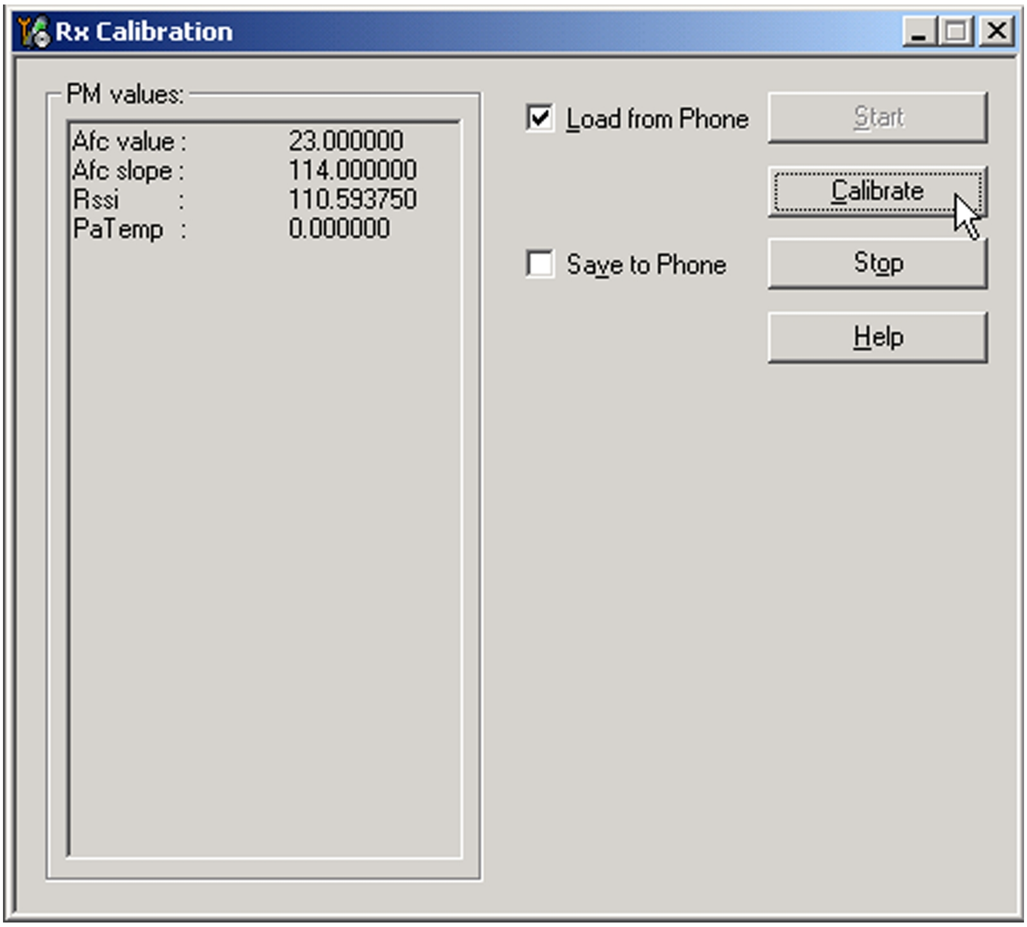
☐ Change with Reset

Band: GSM 900

☑ Load from Phone

☐ Save to Phone

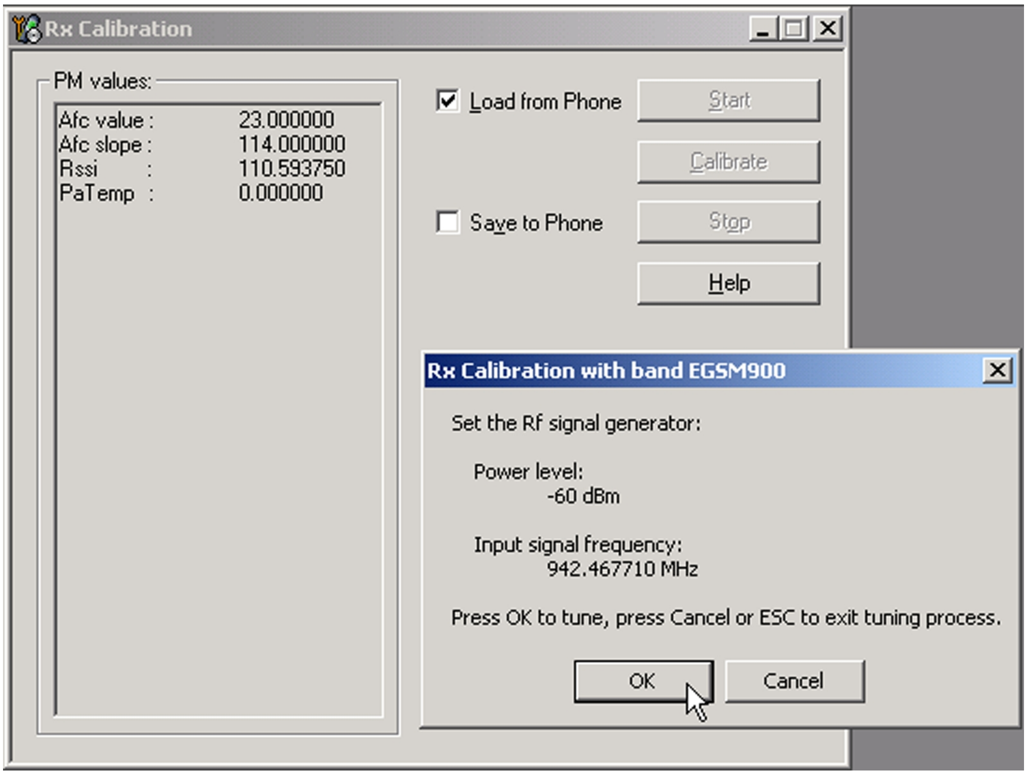
8. Click **Calibrate**.


Rx Calibration
PM values:
☑ Load from Phone
☐ Save to Phone
Start
Calibrate
Stop
Help

Afc value : 23.000000
Afc slope : 114.000000
Rssi : 110.593750
PaTemp : 0.000000

9. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the **Rx Calibration with band EGSM900** pop-up window.

   Important: The calibration uses a non-modulated CW signal. Increase the signal generator level by cable attenuation and module jig probe attenuation.


Rx Calibration
PM values:
☑ Load from Phone
Start
Calibrate
☐ Save to Phone
Stop
Help
Rx Calibration with band EGSM900
OK
Cancel

Afc value : 23.000000
Afc slope : 114.000000
Rssi : 110.593750
PaTemp : 0.000000

Set the Rf signal generator:

Power level:
-60 dBm

Input signal frequency:
942.467710 MHz

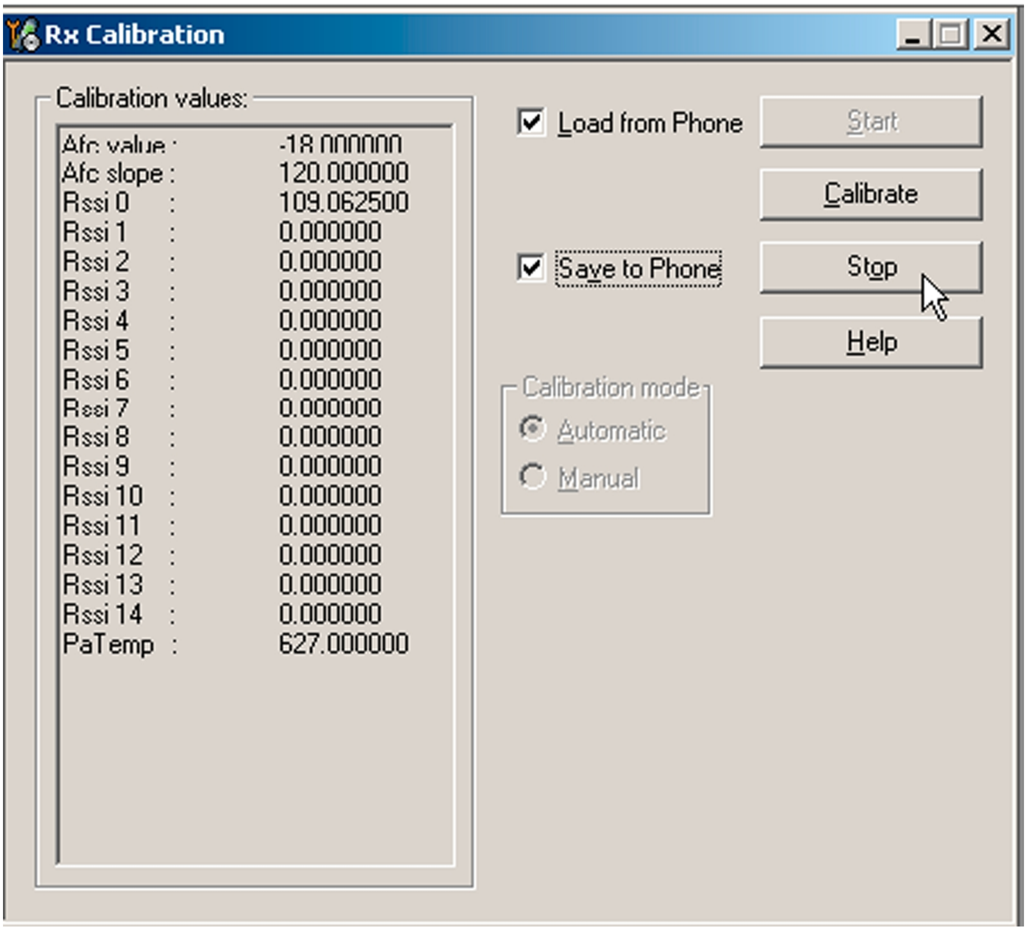
Press OK to tune, press Cancel or ESC to exit tuning process.

10. To perform the tuning, click **OK**.
11. Check that the tuning values are within the limits specified in the following table:

Table 12 RF tuning limits in Rx calibration

	Min	Typ	Max	Unit
GSM850				
AFC Value	-200	-105...62	200	
AFC slope	0	122	200	
RSSI0	106	107...110	114	dB
GSM900				
AFC Value	-200	-105...62	200	
AFC slope	0	122	200	
RSSI0	106	107...110	114	dB
GSM1800				
RSSI0	104	104...109	114	dB
GSM1900				
RSSI0	104	104...109	114	dB

12. To save values to the phone, check the **Save to Phone** check box, and click **Stop**.



Calibration values:

```
Afc value :     -18.000000
Afc slope :     120.000000
Rssi 0    :     109.062500
Rssi 1    :     0.000000
Rssi 2    :     0.000000
Rssi 3    :     0.000000
Rssi 4    :     0.000000
Rssi 5    :     0.000000
Rssi 6    :     0.000000
Rssi 7    :     0.000000
Rssi 8    :     0.000000
Rssi 9    :     0.000000
Rssi 10   :     0.000000
Rssi 11   :     0.000000
Rssi 12   :     0.000000
Rssi 13   :     0.000000
Rssi 14   :     0.000000
PaTemp    :     627.000000
```

☑ Load from Phone

☑ Save to Phone

Calibration mode
● Automatic
○ Manual

Next action

Repeat steps 3 to 8 for GSM850, GSM1800 and GSM1900

Rx band filter response compensation (GSM)

Before you begin

Rx calibration must be done before the Rx Band Filter Response Compensation

Context

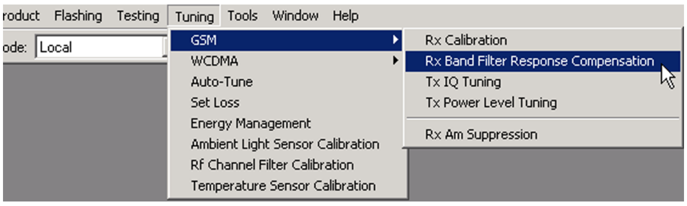
In each GSM Rx band, there’s a band rejecting filter in front of RF ASIC front end. The amplitude ripple caused by these filters causes ripple to the RSSI measurement and therefore calibration is needed.

The calibration has to be repeated for each GSM band.

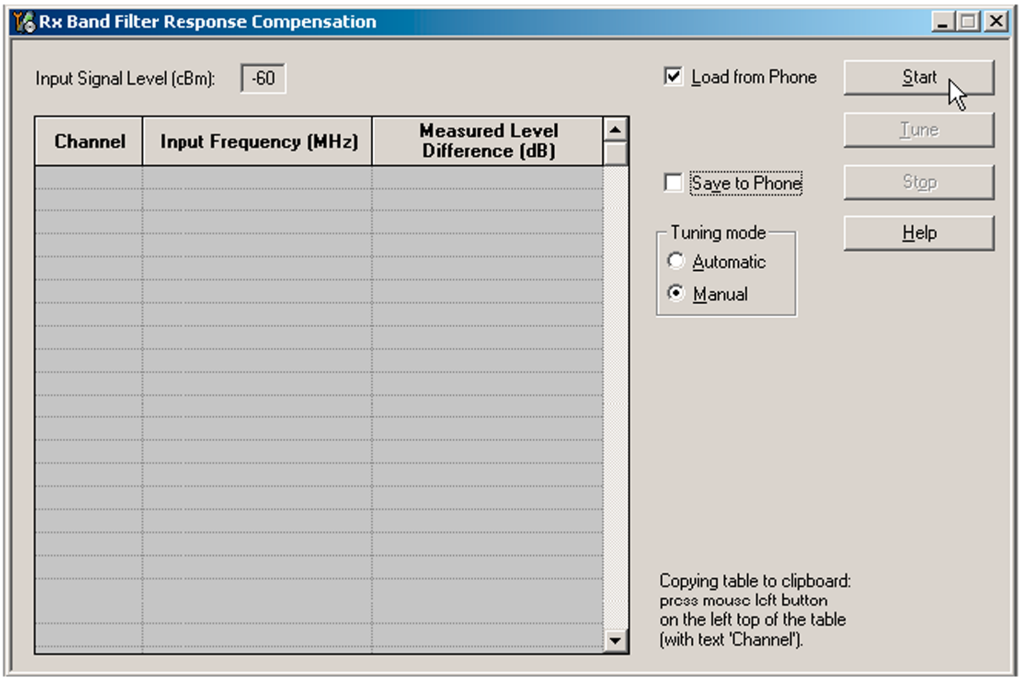
Steps

1. Connect module jig’s GSM connector to signal generator.
2. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and Band to GSM900.

3. From the Tuning menu, choose GSM -> Rx Band Filter Response Compensation.


roduct
Flashing
Testing
Tuning
Tools
Window
Help
ode: Local
GSM
WCDMA
Auto-Tune
Set Loss
Energy Management
Ambient Light Sensor Calibration
Rf Channel Filter Calibration
Temperature Sensor Calibration
Rx Calibration
Rx Band Filter Response Compensation
Tx IQ Tuning
Tx Power Level Tuning
Rx Am Suppression

4. Check “Manual” and “Load from Phone” check boxes. Clear “Save to Phone” check box
5. Click Start.


Rx Band Filter Response Compensation
Start
Tune
Stop
Help

Input Signal Level (cBm): -60

☑ Load from Phone

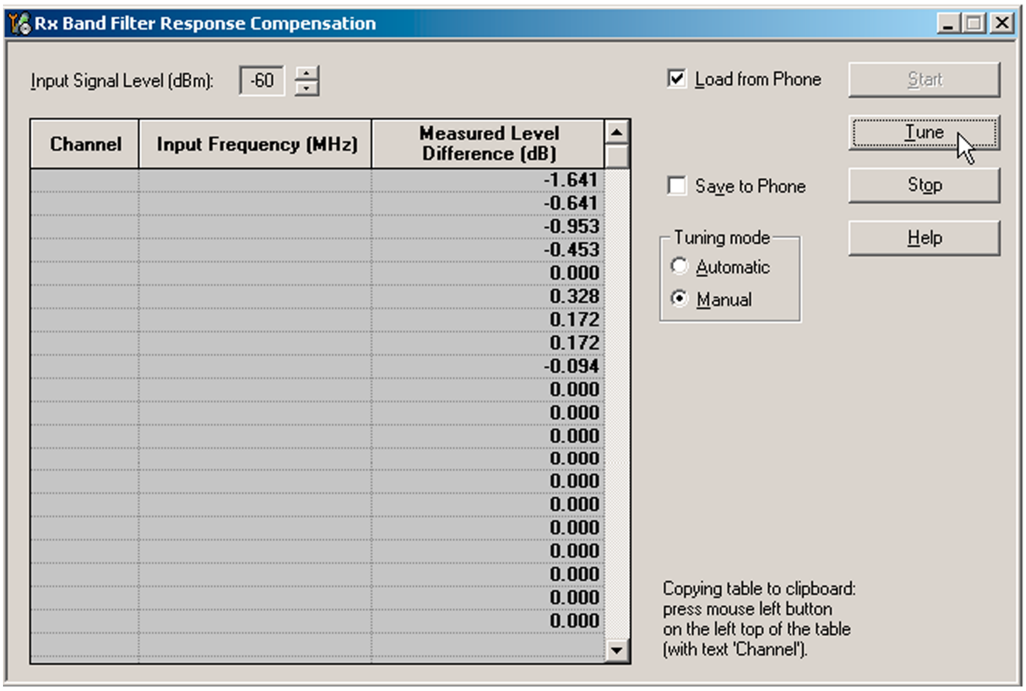
☐ Save to Phone

Tuning mode
○ Automatic
● Manual

Channel	Input Frequency (MHz)	Measured Level Difference (dB)

Copying table to clipboard:
press mouse left button
on the left top of the table
(with text 'Channel').

6. Click Tune.


Rx Band Filter Response Compensation
Start
Tune
Stop
Help

Input Signal Level (dBm): -60

☑ Load from Phone

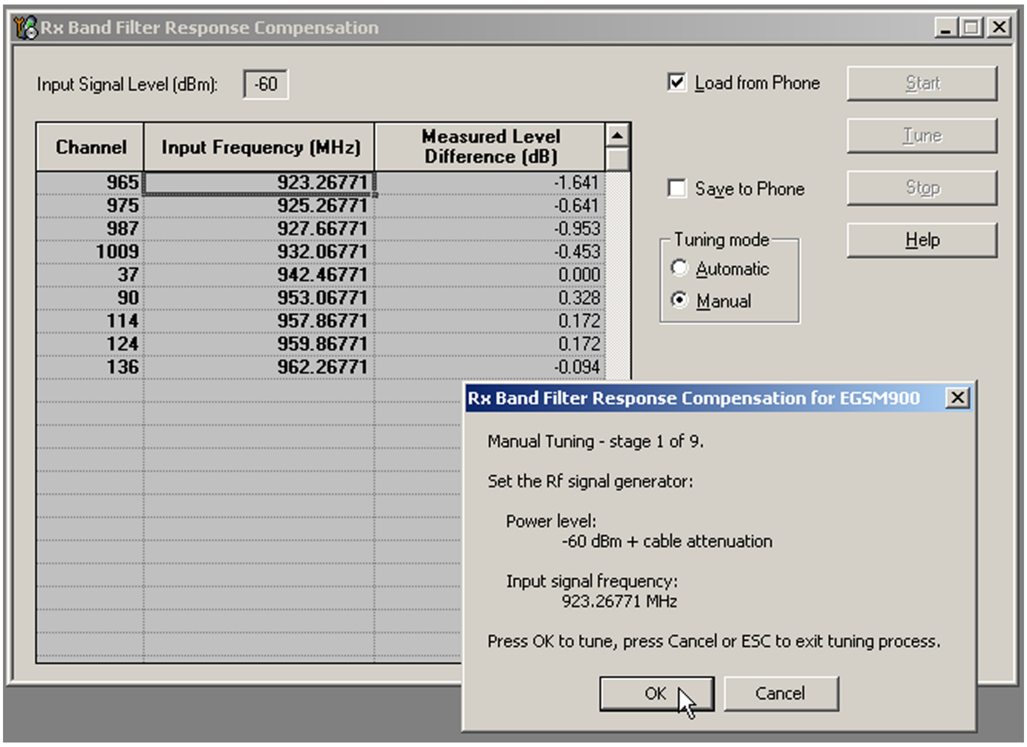
☐ Save to Phone

Tuning mode
○ Automatic
● Manual

Channel	Input Frequency (MHz)	Measured Level Difference (dB)
		-1.641
		-0.641
		-0.953
		-0.453
		0.000
		0.328
		0.172
		0.172
		-0.094
		0.000
		0.000
		0.000
		0.000
		0.000
		0.000
		0.000
		0.000
		0.000
		0.000
		0.000

Copying table to clipboard: press mouse left button on the left top of the table (with text 'Channel').

7. Connect signal generator to the phone and set frequency and amplitude as instructed in the "Rx Band Filter Response Compensation for EGSM900" popup window.


Rx Band Filter Response Compensation
Start
Tune
Stop
Help
Rx Band Filter Response Compensation for EGSM900
OK
Cancel

Input Signal Level (dBm): -60

☑ Load from Phone

☐ Save to Phone

Tuning mode
○ Automatic
● Manual

Channel	Input Frequency (MHz)	Measured Level Difference (dB)
965	923.26771	-1.641
975	925.26771	-0.641
987	927.66771	-0.953
1009	932.06771	-0.453
37	942.46771	0.000
90	953.06771	0.328
114	957.86771	0.172
124	959.86771	0.172
136	962.26771	-0.094

Manual Tuning - stage 1 of 9.

Set the Rf signal generator:

Power level:
-60 dBm + cable attenuation

Input signal frequency:
923.26771 MHz

Press OK to tune, press Cancel or ESC to exit tuning process.

8. To perform tuning, click OK.

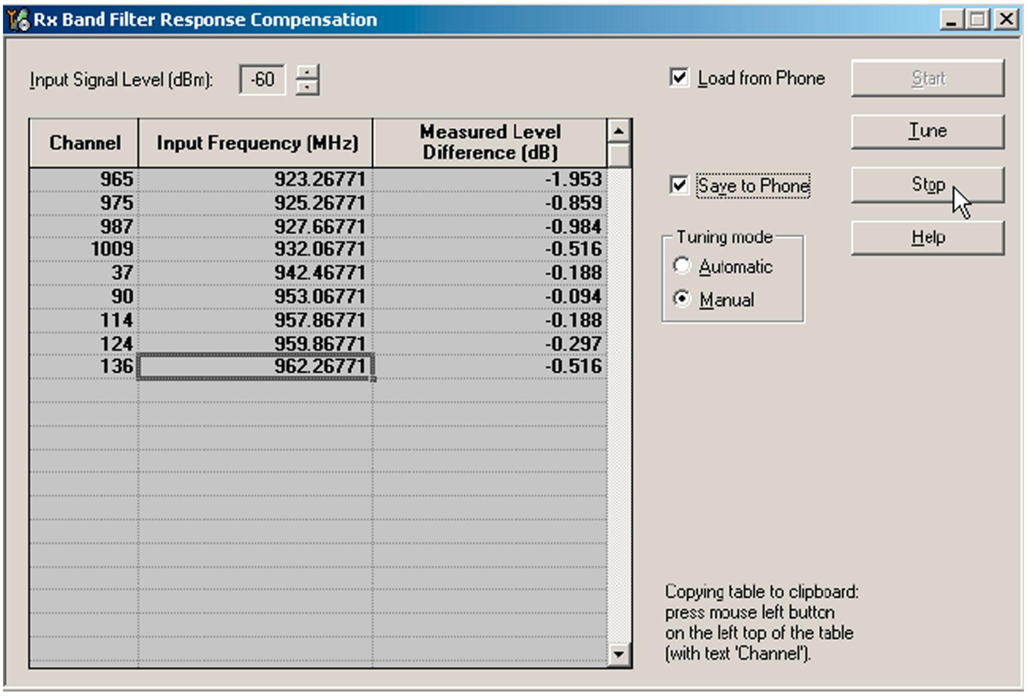
9. Go through all 9 frequencies.

10. Check that the tuning values are within the limits specified in this table:

	Min	Typ	Max	Unit
GSM850				
Ch. 118 / 867.26771 MHz	-10	-1	5	dB
Ch. 128 / 869.26771 MHz	-3	0	5	dB
Ch. 140 / 871.66771 MHz	-3	0	5	dB
Ch. 172 / 878.06771 MHz	-3	0	5	dB
Ch. 190 / 881.66771 MHz	-3	0	5	dB
Ch. 217 / 887.06771 MHz	-3	0	5	dB
Ch. 241 / 891.86771 MHz	-3	0	5	dB
Ch. 251 / 893.86771 MHz	-3	0	5	dB
Ch. 261/ 895.86771 MHz	-10	-1	5	dB
GSM900				
Ch. 965 / 923.26771 MHz	-10	-1	5	dB
Ch. 975 / 925.26771 MHz	-3	0	5	dB
Ch. 987 / 927.66771 MHz	-3	0	5	dB
Ch. 1009 / 932.06771 MHz	-3	0	5	dB
Ch. 37 / 942.46771 MHz	-3	0	5	dB
Ch. 90 / 953.06771 MHz	-3	0	5	dB
Ch. 114 / 957.86771 MHz	-3	0	5	dB
Ch. 124 / 959.86771 MHz	-3	0	5	dB
Ch. 136 / 962.26771 MHz	-10	-1	5	dB
GSM1800				

	Min	Typ	Max	Unit
Ch. 497 / 1802.26771 MHz	-10	-1	5	dB
Ch. 512 / 1805.26771 MHz	-3	0	5	dB
Ch. 535 / 1809.86771 MHz	-3	0	5	dB
Ch. 606 / 1824.06771 MHz	-3	0	5	dB
Ch. 700 / 1842.86771 MHz	-3	0	5	dB
Ch. 791 / 1861.06771 MHz	-3	0	5	dB
Ch. 870 / 1876.86771 MHz	-3	0	5	dB
Ch. 885 / 1879.86771 MHz	-3	0	5	dB
Ch. 908 / 1884.46771 MHz	-10	-1	5	dB
GSM1900				
Ch. 496 / 1927.06771 MHz	-10	-1	5	dB
Ch. 512 / 1930.26771 MHz	-3	0	5	dB
Ch. 537 / 1935.26771 MHz	-3	0	5	dB
Ch. 586 / 1945.06771 MHz	-3	0	5	dB
Ch. 661 / 1960.06771 MHz	-3	0	5	dB
Ch. 736 / 1975.06771 MHz	-3	0	5	dB
Ch. 794 / 1986.66771 MHz	-3	0	5	dB
Ch. 810 / 1989.86771 MHz	-3	0	5	dB
Ch. 835 / 1994.86771 MHz	-10	-1	5	dB

11. Check the "Save to Phone" check box and click Stop if the values are within the limits.


Rx Band Filter Response Compensation
Start
Tune
Stop
Help

Input Signal Level (dBm): -60

☑ Load from Phone

☑ Save to Phone

Tuning mode
○ Automatic
● Manual

Channel	Input Frequency (MHz)	Measured Level Difference (dB)
965	923.26771	-1.953
975	925.26771	-0.859
987	927.66771	-0.984
1009	932.06771	-0.516
37	942.46771	-0.188
90	953.06771	-0.094
114	957.86771	-0.188
124	959.86771	-0.297
136	962.26771	-0.516

Copying table to clipboard:
press mouse left button
on the left top of the table
(with text 'Channel').

Next action

Repeat the steps 4 to 10 for GSM850, GSM1800 and GSM1900.

GSM transmitter tunings

Tx IQ tuning (GSM)

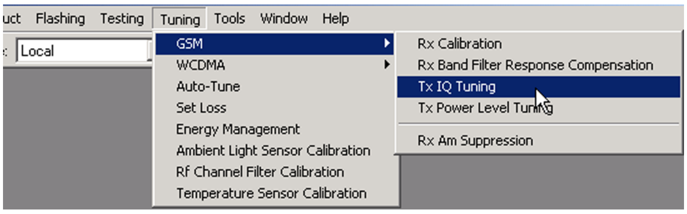
Context

The Tx path branches to I and Q signals at RF I/Q modulator. Modulator and analog hardware located after it cause unequal amplitude and phase disturbance to I and Q signal paths. Tx IQ tuning tuning balances the I and Q branches.

Tx IQ tuning must be performed on all GSM bands. .

Steps

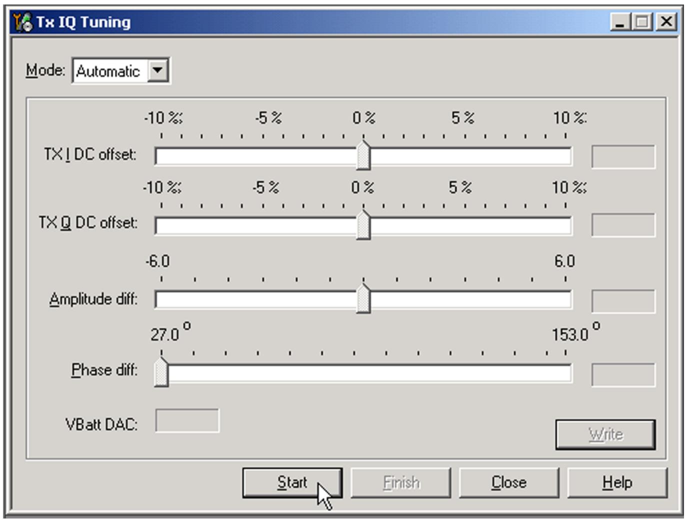
1. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and Band to GSM900.
2. From the Tuning menu, choose GSM -> Tx IQ Tuning.


uct
Flashing
Testing
Tuning
Tools
Window
Help
Local
GSM
WCDMA
Auto-Tune
Set Loss
Energy Management
Ambient Light Sensor Calibration
RF Channel Filter Calibration
Temperature Sensor Calibration
Rx Calibration
Rx Band Filter Response Compensation
Tx IQ Tuning
Tx Power Level Tuning
Rx Am Suppression

3. Set Mode to Automatic and Edge to Off.
4. Click Start.

   Wait until automatic tuning has finished and moved the sliders.

   Values are written to the phone memory automatically.


Tx IQ Tuning
-10 %
-5 %
0 %
5 %
10 %
-6.0
6.0
27.0 °
153.0 °
Write
Start
Finish
Close
Help

Mode: Automatic

TX I DC offset:

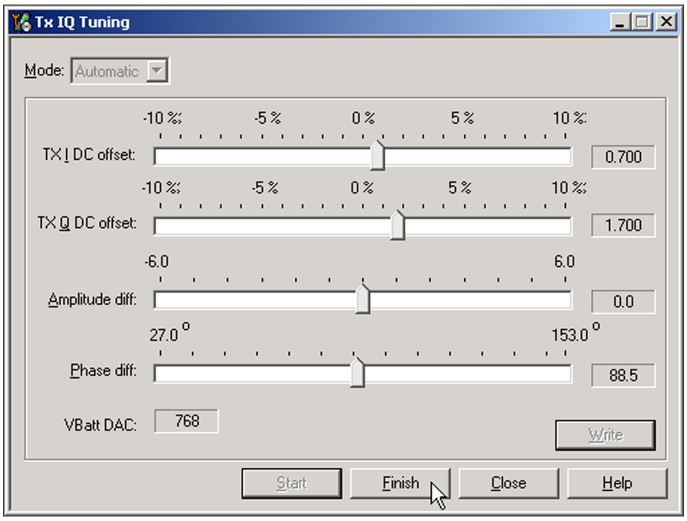
TX Q DC offset:

Amplitude diff:

Phase diff:

VBatt DAC:

5. When the values have been written to the phone memory, click the Finish button to end the tuning.


Tx IQ Tuning
-10 %
-5 %
0 %
5 %
10 %
-6.0
6.0
27.0 °
153.0 °
Write
Start
Finish
Close
Help

Mode: Automatic

TX I DC offset: 0.700

TX Q DC offset: 1.700

Amplitude diff: 0.0

Phase diff: 88.5

VBatt DAC: 768

6. Change band to GSM850 and repeat steps 4 to 5.
7. Change band to GSM1800 and repeat steps 4 to 5.
8. Change band to GSM1900 and repeat steps 4 to 5.
9. To close the tuning window, click Close.

Next action

Tuning sliders should be close to the center of the scale after the tuning and within the limits specified in the table below. If they are not within the limits, check Tx IQ quality manually.

	Min	Typ	Max	Unit
GSM850				
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	○
GSM900				

	Min	Typ	Max	Unit
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	○
GSM1800/GSM1900				
I/Q DC	-6	0.5	6	%
Ampl	-1	0	1	dB
Phase	95	100	110	○

Tx power level tuning (GSM)

Context

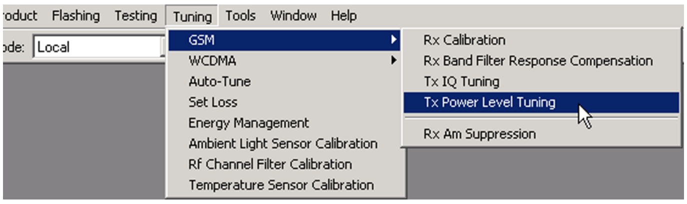
Because of variations at IC process and discrete component values, actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients'. These adjust the GSM transmitter output power to fulfill the specifications.

For EDGE transmission the bias settings of the FEM are adjusted in order to improve linearity. This affects the PA gain and hence the power levels have to be aligned separately for EDGE transmission.

Tx power level tuning has to be performed on all GSM bands.

Steps

1. Connect the phone to a spectrum analyzer.
2. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and Band to GSM900.
3. From the Tuning menu, choose GSM -> Tx Power Level Tuning.


roduct
Flashing
Testing
Tuning
Tools
Window
Help
ode: Local
GSM
WCDMA
Auto-Tune
Set Loss
Energy Management
Ambient Light Sensor Calibration
Rf Channel Filter Calibration
Temperature Sensor Calibration
Rx Calibration
Rx Band Filter Response Compensation
Tx IQ Tuning
Tx Power Level Tuning
Rx Am Suppression

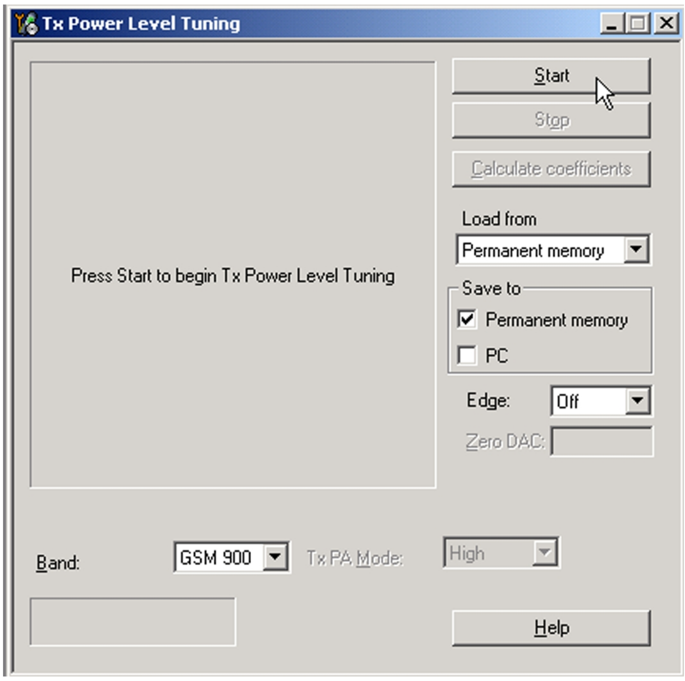
4. Set Mode to Automatic and Edge to Off.
5. Set the spectrum analyzer for power level tuning:

Frequency	channel frequency (836.6MHz GSM850, 897.4MHz GSM900, 1747.8MHz GSM1800, 1880MHz GSM1900)
Span	0 Hz
Sweep time	2ms
Trigger	Video triggering (-10dBm)
Resolution BW	3MHz
Video BW	3MHz
Reference level offset	sum cable attenuation with module jig attenuation

Reference level	33dBm

A power meter with a peak power detector can be also used. Remember to take the attenuations in the account!

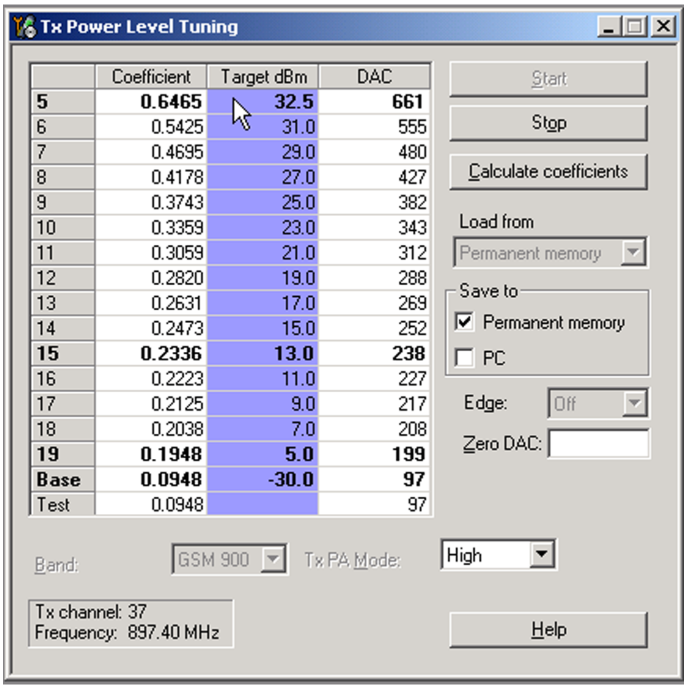
6. Click Start.


Tx Power Level Tuning
Start
Stop
Calculate coefficients
Zero DAC:
Help

Press Start to begin Tx Power Level Tuning

Load from: Permanent memory
Save to: ☑ Permanent memory ☐ PC
Edge: Off
Band: GSM 900
Tx PA Mode: High

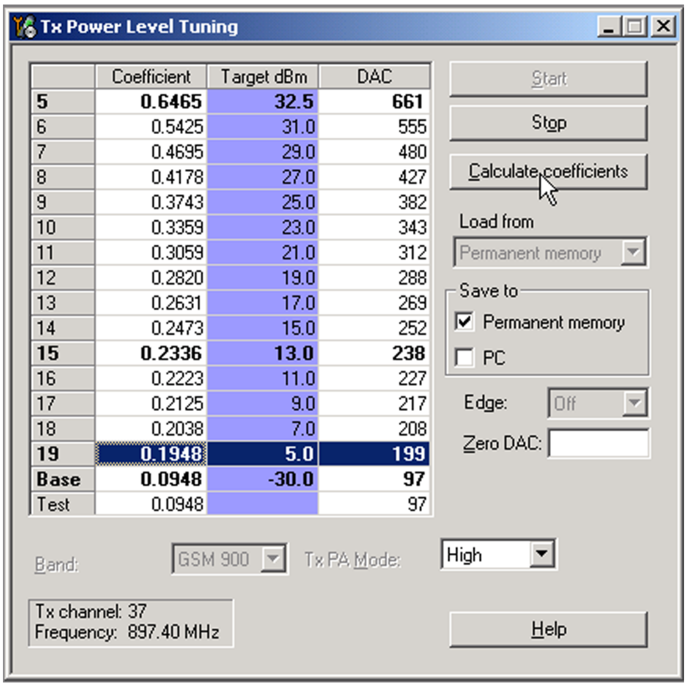
7. Adjust power levels 5, 15 and 19 to correspond the "Target dBm" column by pressing + or – keys.


Tx Power Level Tuning
Start
Stop
Calculate coefficients
Help

	Coefficient	Target dBm	DAC
5	**0.6465**	**32.5**	**661**
6	0.5425	31.0	555
7	0.4695	29.0	480
8	0.4178	27.0	427
9	0.3743	25.0	382
10	0.3359	23.0	343
11	0.3059	21.0	312
12	0.2820	19.0	288
13	0.2631	17.0	269
14	0.2473	15.0	252
15	**0.2336**	**13.0**	**238**
16	0.2223	11.0	227
17	0.2125	9.0	217
18	0.2038	7.0	208
19	**0.1948**	**5.0**	**199**
Base	**0.0948**	**-30.0**	**97**
Test	0.0948		97

Load from: Permanent memory
Save to: ☑ Permanent memory ☐ PC
Edge: Off
Zero DAC:
Band: GSM 900
Tx PA Mode: High
Tx channel: 37
Frequency: 897.40 MHz

8. Click Calculate Coefficients.



	Coefficient	Target dBm	DAC
5	**0.6465**	**32.5**	**661**
6	0.5425	31.0	555
7	0.4695	29.0	480
8	0.4178	27.0	427
9	0.3743	25.0	382
10	0.3359	23.0	343
11	0.3059	21.0	312
12	0.2820	19.0	288
13	0.2631	17.0	269
14	0.2473	15.0	252
15	**0.2336**	**13.0**	**238**
16	0.2223	11.0	227
17	0.2125	9.0	217
18	0.2038	7.0	208
19	**0.1948**	**5.0**	**199**
Base	**0.0948**	**-30.0**	**97**
Test	0.0948		97

Load from: Permanent memory

Save to:
☑ Permanent memory
☐ PC

Edge: Off

Zero DAC:

Band: GSM 900

Tx PA Mode: High

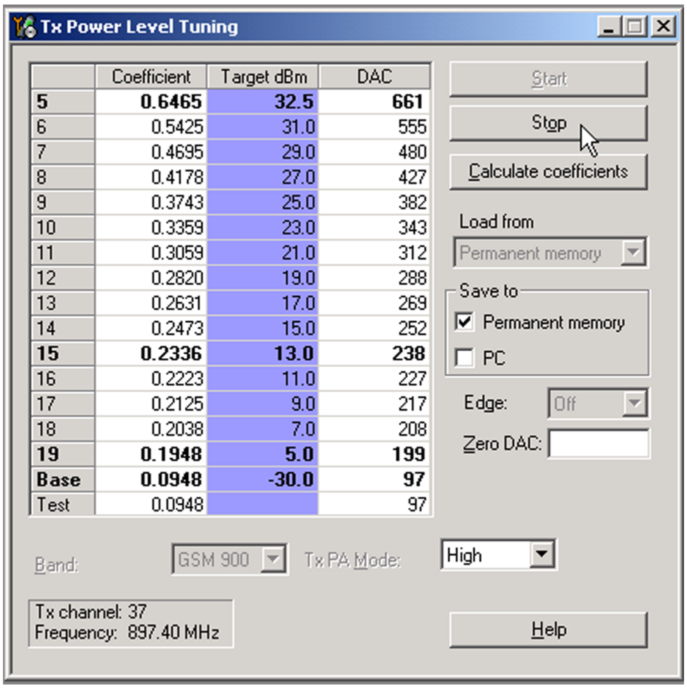
Tx channel: 37
Frequency: 897.40 MHz

9. Check that the coeffiecient values are within the limits specified in the following table.

	Min	Typ	Max
GSM850 EDGE off			
PL5 coefficient	0.45	0.626	0.73
PL15 coefficient		0.234	
PL19 coefficient	0.12	0.195	0.3
GSM850 EDGE on			
PL8 coefficient	0.35	0.419	0.6
PL15 coefficient		0.247	
PL19 coefficient	0.12	0.204	0.3
GSM900 EDGE off			
PL5 coefficient	0.45	0.626	0.73
PL15 coefficient		0.234	
PL19 coefficient	0.12	0.195	0.3
GSM900 EDGE on			
PL8 coefficient	0.35	0.419	0.6
PL15 coefficient		0.247	
PL19 coefficient	0.12	0.204	0.3
GSM1800 EDGE off			
PL0 coefficient	0.45	0.51	0.7
PL11 coefficient		0.219	

	Min	Typ	Max
PL15 coefficient	0.12	0.185	0.3
GSM1800 EDGE on			
PL2 coefficient	0.35	0.394	0.6
PL11 coefficient		0.23	
PL15 coefficient	0.12	0.194	0.3
GSM1900 EDGE off			
PL0 coefficient	0.45	0.482	0.7
PL11 coefficient		0.218	
PL15 coefficient	0.12	0.184	0.3
GSM1900 EDGE on			
PL2 coefficient	0.35	0.377	0.6
PL11 coefficient		0.23	
PL15 coefficient	0.12	0.193	0.3

If the values are within the limits, check that the "Save to Phone Permanent Memory" check box is checked and click Stop.



	Coefficient	Target dBm	DAC
5	**0.6465**	**32.5**	**661**
6	0.5425	31.0	555
7	0.4695	29.0	480
8	0.4178	27.0	427
9	0.3743	25.0	382
10	0.3359	23.0	343
11	0.3059	21.0	312
12	0.2820	19.0	288
13	0.2631	17.0	269
14	0.2473	15.0	252
15	**0.2336**	**13.0**	**238**
16	0.2223	11.0	227
17	0.2125	9.0	217
18	0.2038	7.0	208
19	**0.1948**	**5.0**	**199**
Base	**0.0948**	**-30.0**	**97**
Test	0.0948		97

Load from: Permanent memory

Save to
☑ Permanent memory
☐ PC

Edge: Off

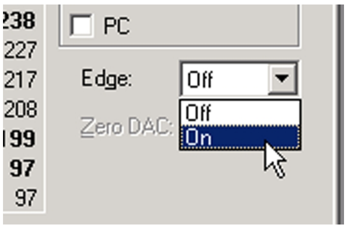
Zero DAC:

Band: GSM 900

Tx PA Mode: High

Tx channel: 37
Frequency: 897.40 MHz

10. Set **Edge** mode on and start tuning again. Change video averaging to 50.



☐ PC

Edge: Off

Zero DAC:

11. Tune EDGE power levels to the corresponding target power levels.

    Only power levels **8**, **15** and **19** are tuned in GSM900 and **2**, **10** and **15** in GSM1800/1900. The rest are calculated by clicking the Calculate Coefficients button. Check the coefficients against the RF tuning limits table presented in Step 9.
12. When the tuning is completed, click Stop.

Next action

Repeat steps 4 to 9 for GSM1800 and GSM1900. On those bands only power levels **0**, **11** and **15** need to be tuned.

8 — Camera Module Troubleshooting

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Introduction to camera module troubleshooting

Background, tools and terminology

Faults or complaints in camera operation can be roughly categorised into three subgroups:

1. Camera is not functional at all; no image can be taken.
2. Images can be taken but there is nothing recognizable in them.
3. Images can be taken and they are recognizable but for some reason the quality of images is seriously degraded.

Image quality is very hard to measure quantitatively, and even comparative measurements are difficult (comparing two images) to do, if the difference is small. Especially if the user is not satisfied with his/her device's image quality, and tells, for example, that the images are not sharp, it is fairly difficult to accurately test the device and get an exact figure which would tell whether the device is functioning properly.

Often subjective evaluation has to be used for finding out if a certain property of the camera is acceptable or not. Some training or experience of a correctly operating reference device may be needed in order to detect what actually is wrong.

It is easy for the user to take bad images in bad conditions. Therefore the camera operation has to be checked always in constant conditions (lighting, temperature) or by using a second, known-to-be good device as reference.

When checking for possible errors in camera functionality, knowing what error is suspected significantly helps the testing by narrowing down the amount of test cases. The following types of image quality problems may be expected to appear:

- Dust (black spots)
- Lack of sharpness
- Bit errors

Terms

Dynamic range	Camera's ability to capture details in dark and bright areas of the scene simultaneously.
Exposure time	Camera modules use silicon sensor to collect light and for forming an image. The imaging process roughly corresponds to traditional film photography, in which exposure time means the time during which the film is exposed to light coming through optics. Increasing the time will allow for more light hitting the film and thus results in brighter image. The operation principle is exactly the same with silicon sensor, but the shutter functionality is handled electronically i.e. there is no mechanical moving parts like in film cameras.
Flicker	Phenomenon, which is caused by pulsating in scene lighting, typically appearing as wide horizontal stripes in an image.
Noise	Variation of response between pixels with same level of input illumination.
Resolution	Usually the amount of pixels in the camera sensor; for example, RM-10/ RM-24 has a 1600 x 1200 pixel sensor resolution. In some occasions the term resolution is used for describing the sharpness of the images.

Sensitivity	Camera module's sensitivity to light. In equivalent illumination conditions, a less sensitive camera needs a longer exposure time to gather enough light in forming a good image. Analogous to ISO speed in photographic film.
Sharpness	Good quality images are 'sharp' or 'crisp', meaning that image details are well visible in the picture. However, certain issues, such as non-idealities in optics, cause image blurring, making objects in picture to appear 'soft'. Each camera type typically has its own level of performance.

■ The effect of image taking conditions on image quality

There are some factors, which may cause poor image quality, if not taken into account by the end user when shooting images, and thus may result in complaints. The items listed are normal to camera operation and are not a reason for changing the camera module.

Distance to target

The lens in the module is specified to operate satisfactorily from 40 cm to infinite distance of scene objects. In practice, the operation is such that close objects may be noticed to get more blurred when distance to them is shorter than 40 cm. The lack of sharpness is first visible in full resolution images. If observing just the viewfinder, even very close objects may seem to appear sharp. This is normal; do not change the camera module.

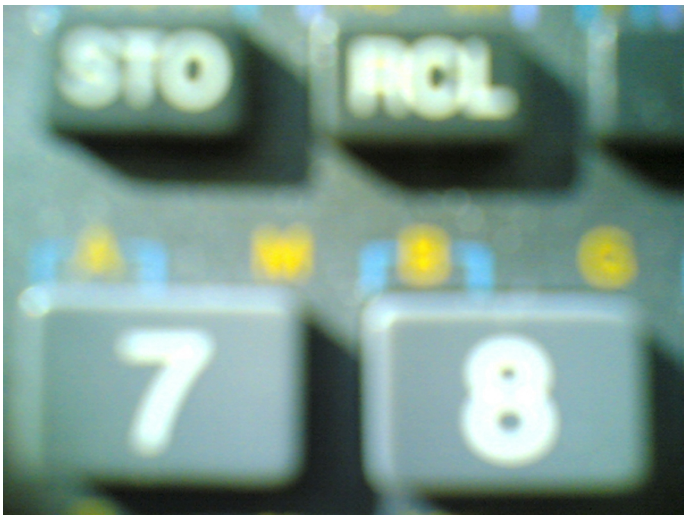


Figure 58 Blurred image. Target too close.

The amount of light available

In dim conditions camera runs out of sensitivity. The exposure time is long (especially in the night mode) and the risk of getting shaken (= blurred) images increases. In addition, image noise level grows. The maximum exposure time in the night mode is ¼ seconds. Therefore, images need to be taken with extreme care and by supporting the phone when the amount of light reflected from the target is low. Because of the longer exposure time and larger gain value, noise level increases in low light conditions. Sometimes blurring may even occur in daytime, if the image is taken very carelessly. See the figure below for an example. This is normal; do not change the camera module.

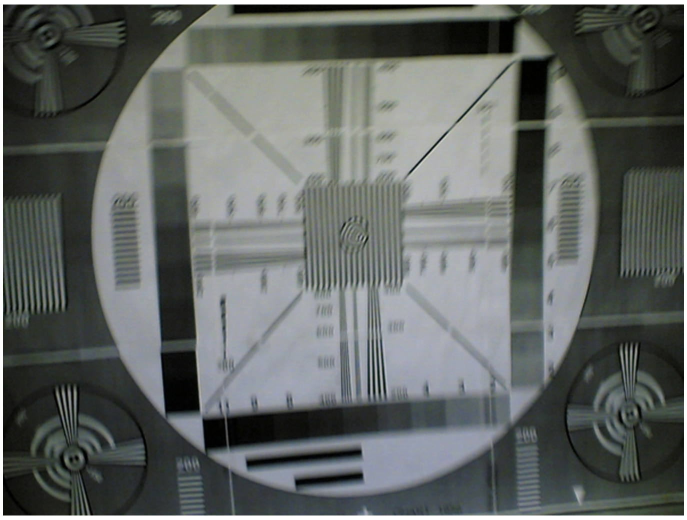


Figure 59 Blurring caused by shaking hands

Movement in bright light

If an image is taken of moving objects or if the device is used in a moving vehicle, object 'skewing' or 'tilting' may occur. This phenomenon is fundamental to most CMOS camera types, and usually cannot be avoided. The movement of camera or object sometimes cause blurring indoors or in dim lighting conditions because of long exposure time. This is normal; do not change the camera module.

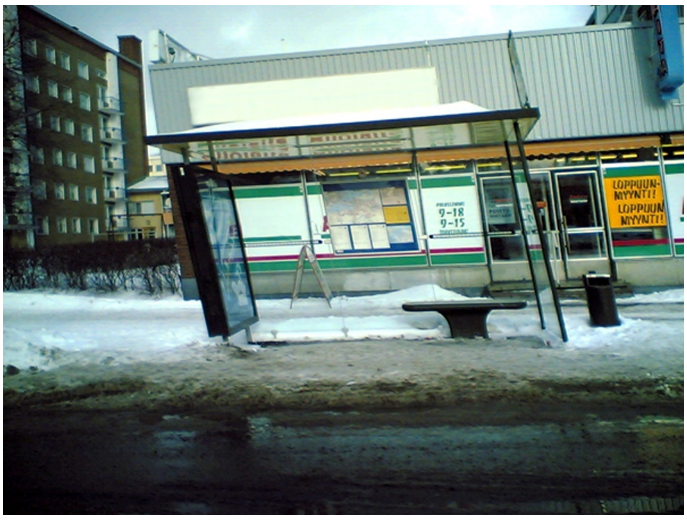


Figure 60 Near objects get skewed when taking images from a moving vehicle

Temperature

High temperatures inside the mobile phone cause more noise to appear in images. For example, in +70 degrees (Celsius), the noise level may be very high, and it further grows if the conditions are dim. If the phone processor has been heavily loaded for a long time before taking an image, the phone might have considerably higher temperature inside than in the surrounding environment. This is also normal to camera operation; do not change the camera module.

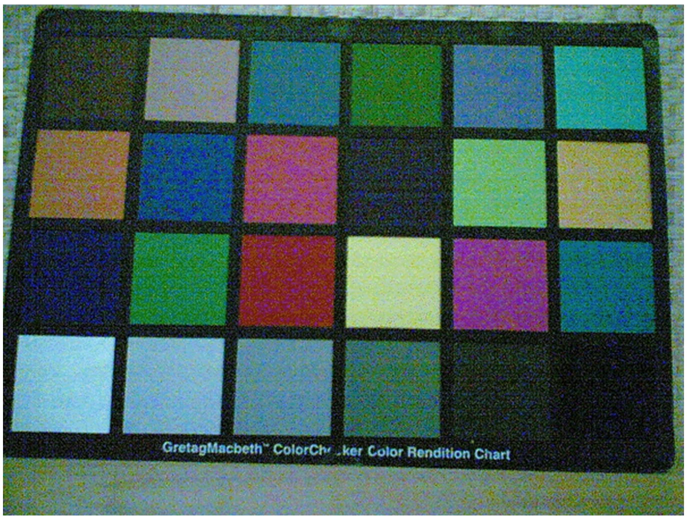


Figure 61 Noisy image taken in +70 degrees Celsius

Phone display

If the display contrast is set too dark, the image quality degrades: the images may be very dark depending on the setting. If the display contrast is set too bright, image contrast appears bad and "faint". This problem is solved by setting the display contrast correctly. This is normal behaviour; do not change the camera module.

Basic rules of photography (especially shooting against light)

Because of dynamic range limitations, taking images against bright light might cause either saturated image or the actual target appear too dark. In practice, this means that when taking an image indoors and having, for example, a window behind the object, the result is usually poor. This is normal behaviour; do not change the camera module.

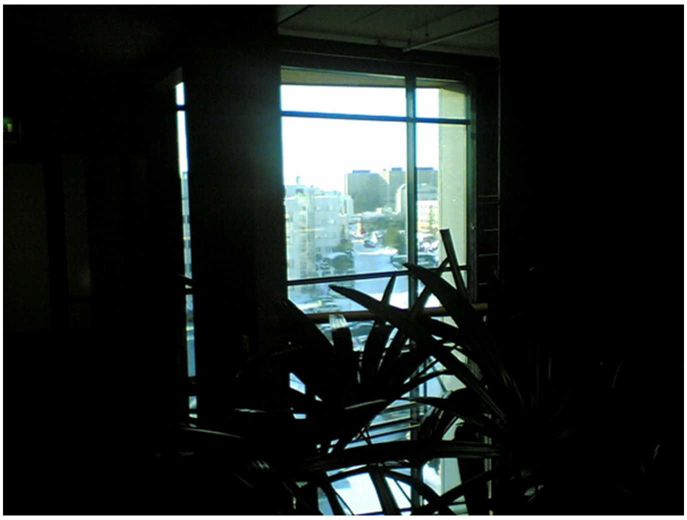


Figure 62 Image taken against light

Flicker

In some occasions a bright fluorescent light may cause flicker in the viewfinder and captured image. This phenomenon may also be a result, if images are taken indoors under the mismatch of 50/60 Hz electricity network frequency. The electricity frequency used is automatically detected by the camera module. In some very few countries, both 50 and 60 Hz networks are present and thus probability for the phenomenon increases. Flickering occurs also under high artificial illumination level. This is normal behaviour; do not change the camera module.

Figure 63 Flicker in an image; object illuminated by strong fluorescent light

Bright light outside of image view

Especially the sun can cause clearly visible lens glare phenomenon and poor contrast in images. This happens because of undesired reflections inside the camera optics. Generally this kind of reflections are common in all optical systems. This is normal behaviour; do not change the camera module.

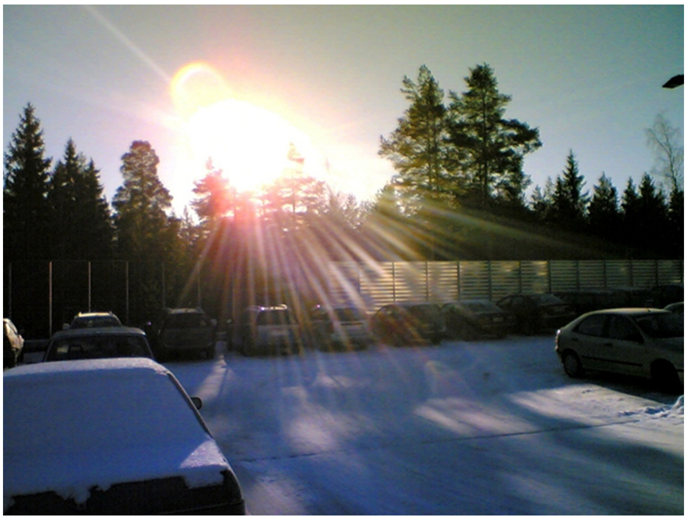


Figure 64 A lens reflection effect caused by sunshine

Examples of good quality images

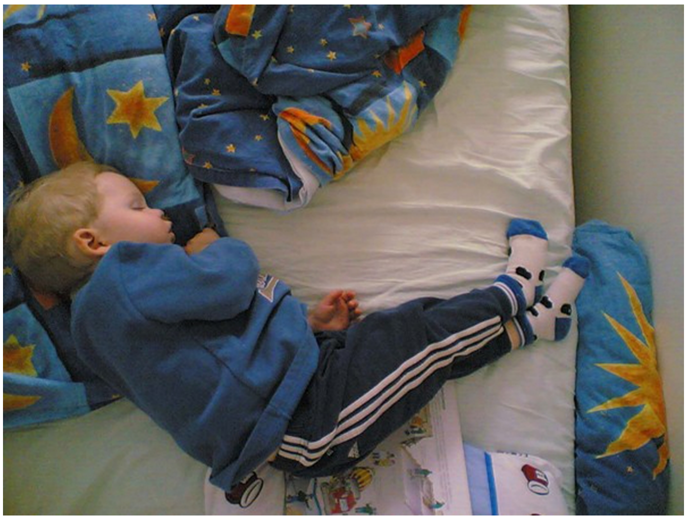


Figure 65 Good image taken indoors

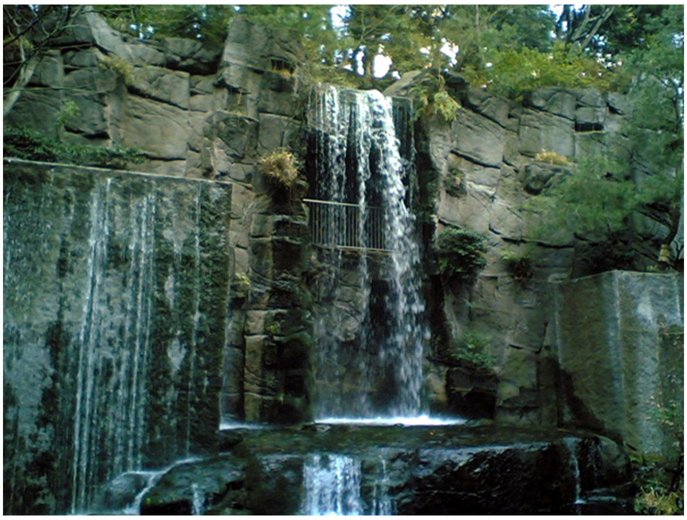


Figure 66 Good image taken outdoors

Camera construction

This section describes the mechanical construction of the camera module for getting a better understanding of the actual mechanical structure of the module.

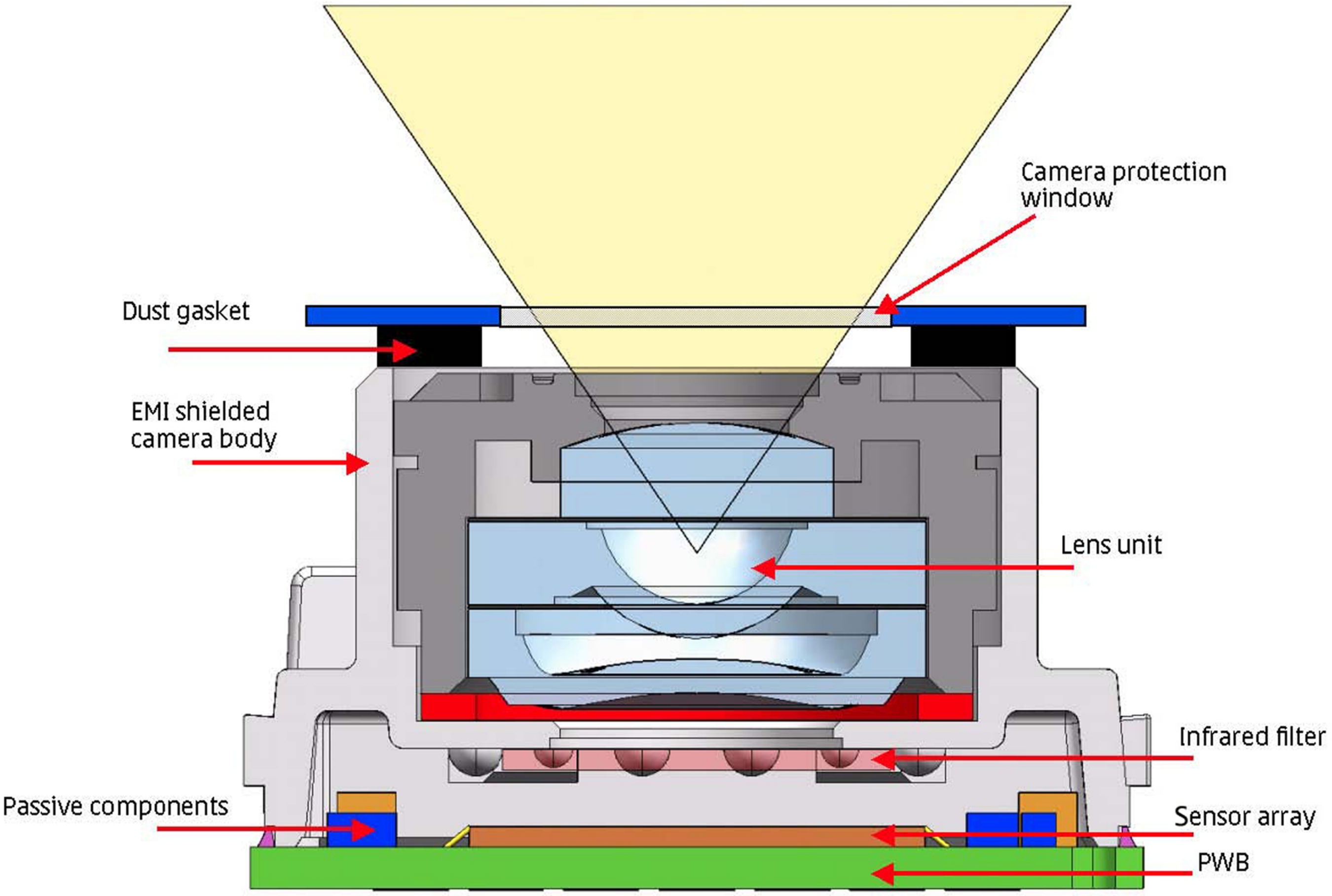

Camera protection window
Dust gasket
EMI shielded camera body
Lens unit
Infrared filter
Passive components
Sensor array
PWB

Figure 67 Camera module cross section and assembly principle

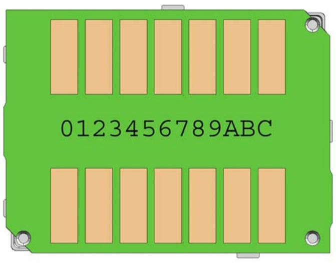

0123456789ABC

Figure 68 Camera module bottom view including serial numbering

The camera module as a component is not a repairable part, meaning that the components inside the module may not be changed. Cleaning dust from the front face is allowed only. Use clean compressed air.

The camera module uses socket type connecting. For versioning, laser marked serial numbering is used on the PWB.

The main parts of the module are:

- Lens unit including lens aperture.
- Infrared filter; used to prevent infrared light from contaminating the image colors. The IR filter is glued to the EMI shielded camera body.
- Camera body; made of conductive metallized plastic and attached to the PWB with glue.
- Sensor array including DSP functions is glued and wire-bonded to the PWB.
- PWB, FR-4 type

- Socket type connection
- Laser-marked serial numbering on PWB (for versioning)
- Passive components
- Camera protection window; part of the phone cover mechanics
- Dust gasket between the lens unit and camera protection window

Image quality analysis

Testing for dust in camera module

Symptoms and diagnosis

For detecting dust problems, take an image of a uniform white surface and analyse it in full resolution. A good quality PC CRT monitor is preferred for analysis (avoid using LCD). Search carefully because finding these defects is not always easy. Figure "Effects of dust on optical path" is an example of an image having easily detectable dust problems.

When taking a white image, use uniformly lightened white paper or white wall. Another option is to use uniform light but in this case make sure that the camera image is not flickering when taking the test image. In case flickering occurs, try to reduce the illumination level. Use JPEG image format for analysing, and set the image quality parameter to ‘High Quality’.

Black spots in an image are caused by dirt particles trapped inside the optical system. Clearly visible and sharp edged black dots in an image are typically dust particles on the image sensor. These spots are searched for in the manufacturing phase, but it is possible that the camera body cavity contains a particle, which may move onto the image sensor active surface, for example, when the phone is dropped. Therefore it is also possible that the problem will disappear before the phone is brought to service. The camera should be replaced if the problem is present when the service technician analyses the phone.

If dust particles are lying on the infrared filter surface on either side, they are hard to locate because they are out of focus, and appear in the image as large, grayish and fading-edge 'blobs'. Sometimes they are invisible to the eye, and the user probably does not notice them at all. However, it is possible that a larger particle disturbs the user, causing need for service.

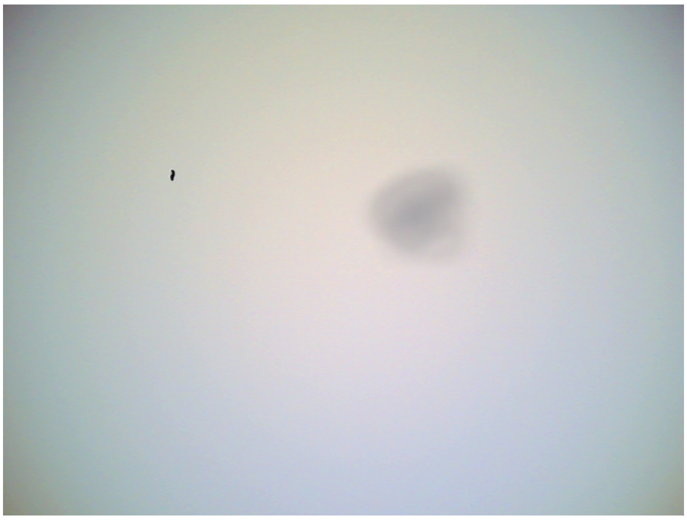


Figure 69 Effects of dust on optical path

If large dust particles get trapped on top of the lens surface in the cavity between the camera window and the lens, they will cause image blurring and poor contrast. The dust gasket between the window and lens should prevent any particles from getting into the cavity after the manufacturing phase.

If dust particles are found on the sensor, this is classified as a manufacturing error of the module, and the camera should be replaced. Any particles inside the cavity between the protection window and the lens have most probably been trapped there in the assembly phase at a Nokia factory. Unauthorized disassembling of the product can also be the root of the problem. However, in most cases it should be possible to remove the particle(s) by using clean compressed air. Never wipe the lens surface before trying compressed air; the possibility of damaging the lens is substantial. Always check the image sharpness after removing dust.

Testing camera image sharpness

Symptoms and diagnosis

If pictures taken with a device are claimed to be blurry, there are six possible sources for the problem:

1 The protection window is fingerprinted, soiled, dirty, visibly scratched or broken.

2 The photographed object is too close – the camera lens operates with distances from 40 cm to infinity. This is no cause to replace camera module.

3 User has tried to take pictures in too dark conditions, and images are blurred due to handshake or movement. This is no cause to replace camera module.

4 There is dirt between the protection window and camera lens.

5 The protection window is defective. This can be either a manufacturing failure or caused by the user. The window should be changed.

6 The camera lens is misfocused because of a manufacturing error.

A quantitative analysis of sharpness is very difficult to conduct in any other environment than optics laboratory. Therefore, subjective analysis should be used.

If no visible defects (items 1-4) are found, a couple of test images should be taken. Generally, a well-illuminated typical indoor scene can be used as a target. The main considerations are:

- The protection window has to be clean.
- The amount of light (300 – 600 lux (bright office lighting)) is sufficient.
- The scene should contain, for example, small objects for checking sharpness. Their distance should be 1 – 2 meters.
- If possible, compare the image to another image of the same scene, taken with a different device. Note that the reference device has to be a similar Nokia phone.

Steps

1. Take several images of small objects in the distance of 1-2 metres.
2. Analyse the images on a PC screen at 100% scaling with the reference images.

   Pay attention to the computer display settings: at least 65000 colors (16-bit) have to be used. True colour (24-bit, 16 million colours) or 32-bit (full colour) setting is recommended.

Next action

If there appears to be a clearly noticeable difference between the reference image and the test images, the module might have a misfocused lens -> change the module.

Re-check the resolution after changing the camera module.

If the changed module produces the same result, the fault is probably in the camera window. Check the window by looking carefully through it when replacing the module.

Dirty camera lens protection window

The following series of images demonstrates the effects of fingerprints on the camera protection window.

It should be noted that the effects of any dirt in images can vary much. It may be difficult to judge whether the window has been dirty or if something else is wrong. Therefore, the cleanness of the protection window should always be checked and the window should be wiped clean with a suitable cloth.

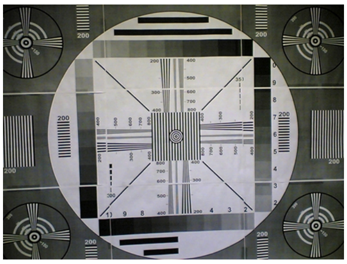


Figure 70 Image taken with clean protection window

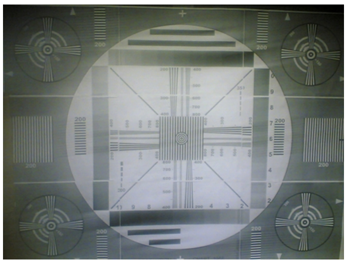


Figure 71 Image taken with greasy protection window

Image bit errors

Bit errors are image defects caused by data transmission errors between the camera module and the phone baseband and/or errors inside the module.

Usually bit errors can be easily detected in images, and they are best visible in full resolution images. A good practice is to use a uniform white test target when analysing these errors. The errors are clearly visible, colourful sharp dots or lines in camera images. See the following figure.

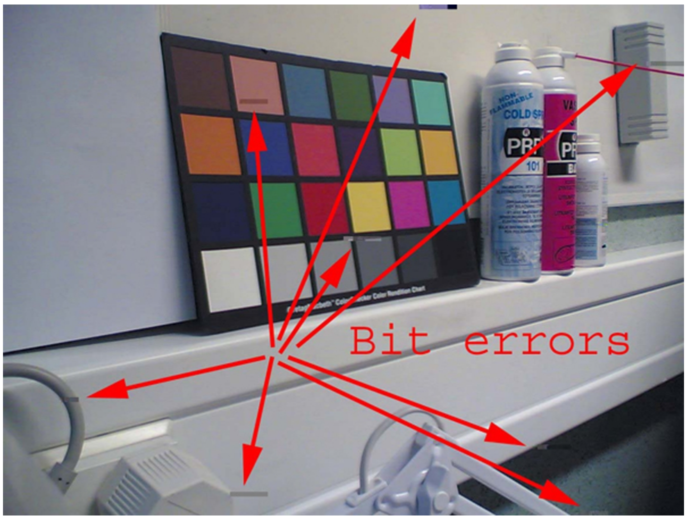


Figure 72 Bit errors caused by JPEG compression

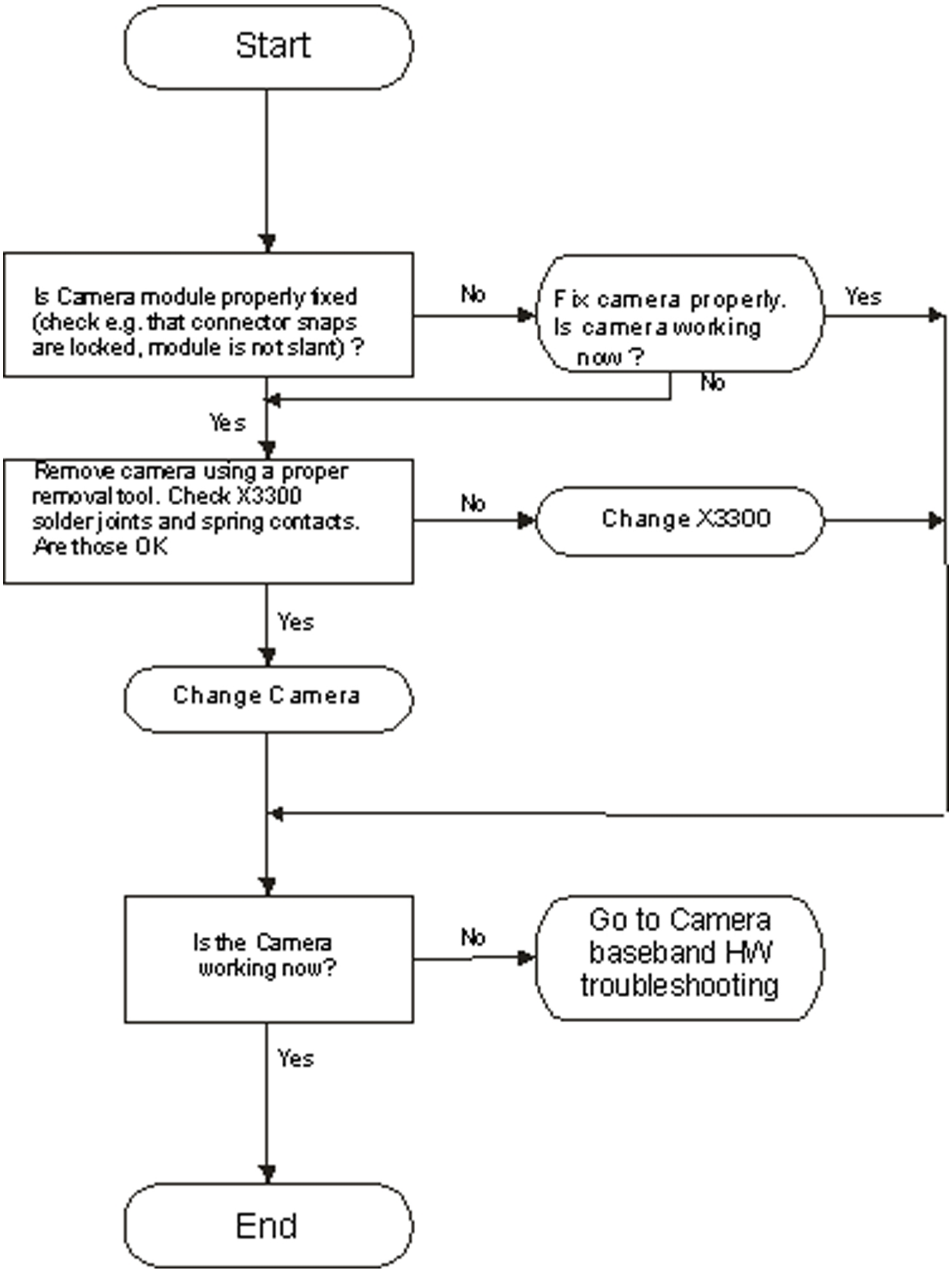
One type of bit error is a lack of bit depth. In this case, the image is almost totally black under normal conditions, and only senses something in very highly illuminated environments. Typically this is a contact problem between the camera module and the phone main PWB. You should check the camera assembly and connector contacts.

If the fault is in the camera module, bit errors are typically visible only when using some specific image resolution. For example, in case of a viewfinder fault, the error might exist but is not visible in a full size image.

Camera troubleshooting flowcharts

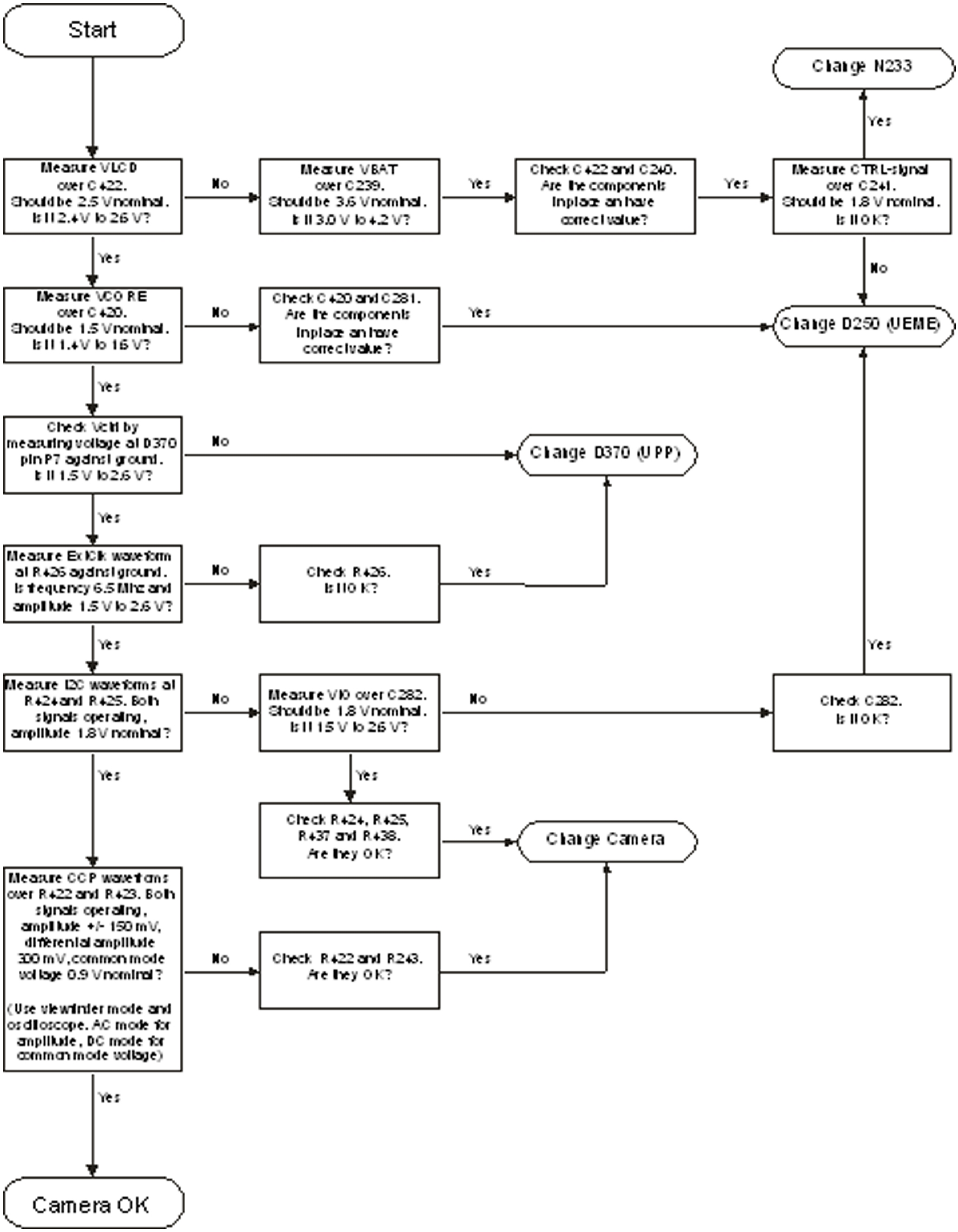
Camera hardware failure message troubleshooting

Troubleshooting flow


Start
Is Camera module properly fixed (check e.g. that connector snaps are locked, module is not slant) ?
No
Fix camera properly. Is camera working now ?
Yes
No
Yes
Remove camera using a proper removal tool. Check X3300 solder joints and spring contacts. Are those OK
No
Change X3300
Yes
Change Camera
Is the Camera working now?
No
Go to Camera baseband HW troubleshooting
Yes
End

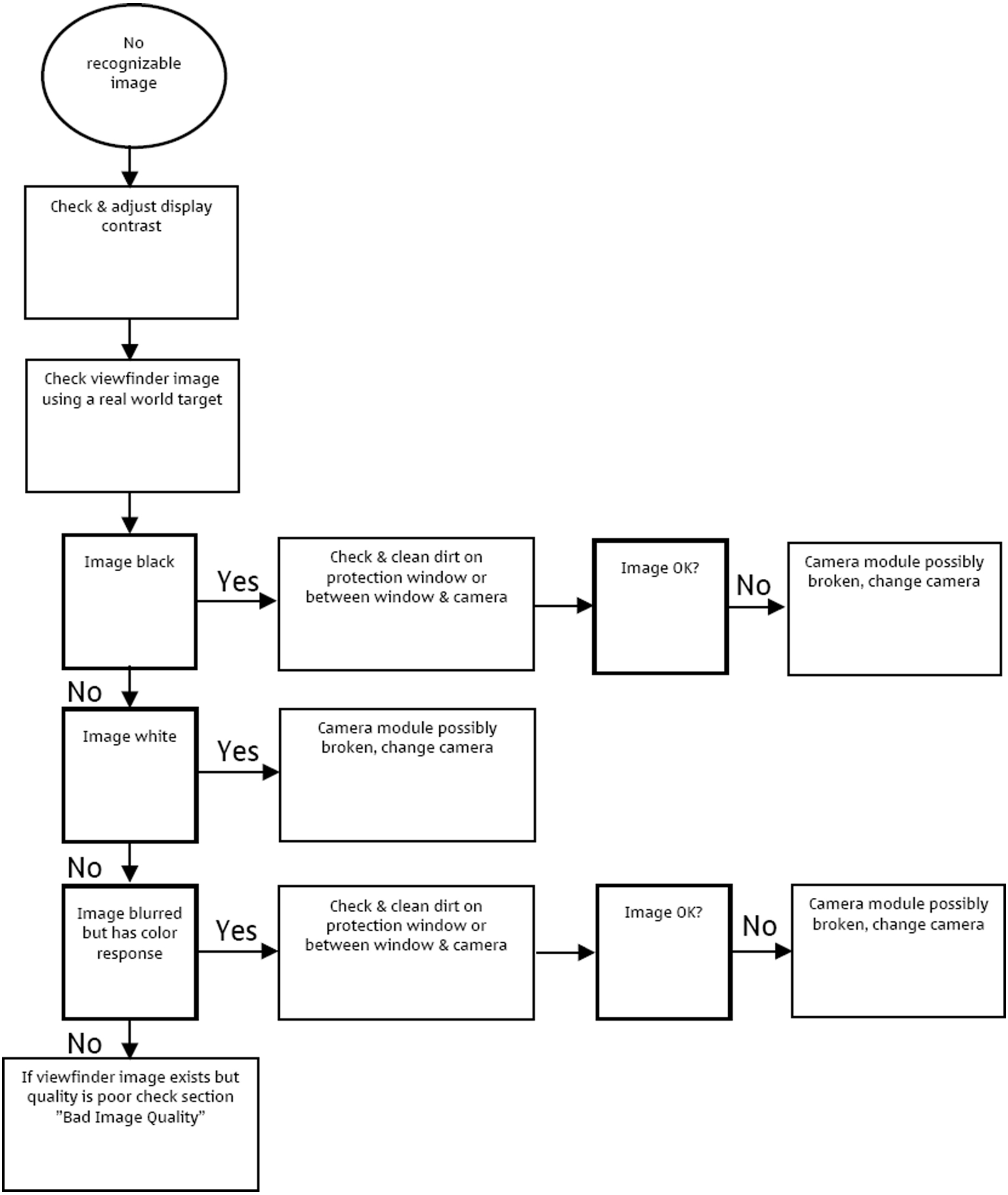
Camera baseband hardware troubleshooting

Troubleshooting flow


Start
Measure VLCD over C422. Should be 2.5 V nominal. Is it 2.4 V to 2.6 V?
No
Measure VBAT over C239. Should be 3.6 V nominal. Is it 3.0 V to 4.2 V?
Yes
Check C422 and C240. Are the components inplace an have correct value?
Yes
Measure CTRL-signal over C241. Should be 1.8 V nominal. Is it OK?
Yes
Change N233
No
Yes
Measure VCORE over C420. Should be 1.5 V nominal. Is it 1.4 V to 1.6 V?
No
Check C420 and C281. Are the components inplace an have correct value?
Yes
Change D250 (UEME)
Yes
Check Vctrl by measuring voltage at D370 pin P7 against ground. Is it 1.5 V to 2.6 V?
No
Change D370 (UPP)
Yes
Measure ExtClk waveform at R426 against ground. Is frequency 6.5 Mhz and amplitude 1.5 V to 2.6 V?
No
Check R426. Is it OK?
Yes
Yes
Measure I2C waveforms at R424 and R425. Both signals operating, amplitude 1.8 V nominal?
No
Measure VIO over C282. Should be 1.8 V nominal. Is it 1.5 V to 2.6 V?
No
Check C282. Is it OK?
Yes
Yes
Check R424, R425, R437 and R438. Are they OK?
Yes
Change Camera
Yes
Measure CCP waveforms over R422 and R423. Both signals operating, amplitude +/- 150 mV, differential amplitude 300 mV, common mode voltage 0.9 V nominal?
(Use viewfinder mode and oscilloscope. AC mode for amplitude, DC mode for common mode voltage)
No
Check R422 and R243. Are they OK?
Yes
Yes
Camera OK

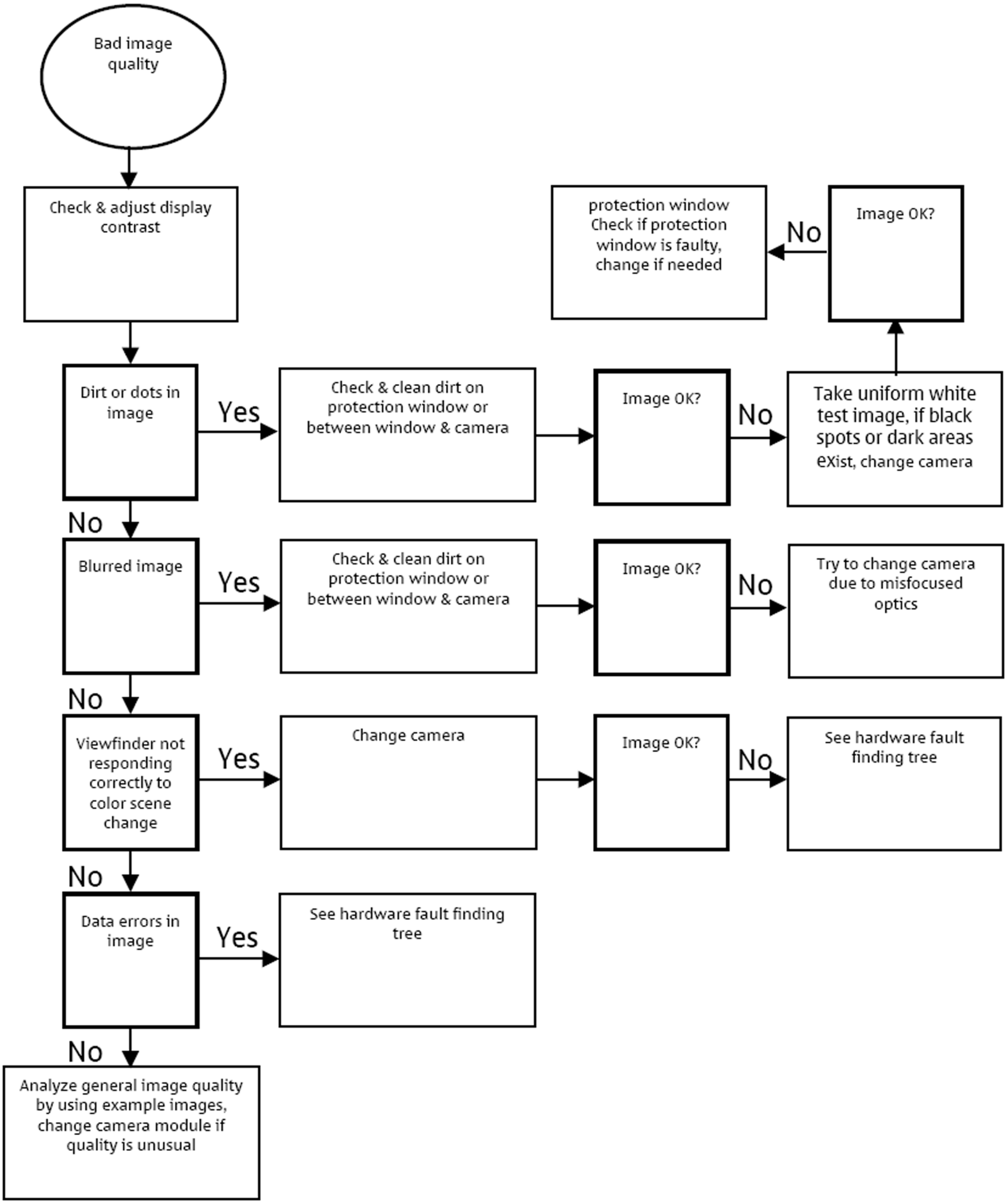
Front camera viewfinder troubleshooting

Troubleshooting flow


No recognizable image
Check & adjust display contrast
Check viewfinder image using a real world target
Image black
Yes
Check & clean dirt on protection window or between window & camera
Image OK?
No
Camera module possibly broken, change camera
No
Image white
Yes
Camera module possibly broken, change camera
No
Image blurred but has color response
Yes
Check & clean dirt on protection window or between window & camera
Image OK?
No
Camera module possibly broken, change camera
No
If viewfinder image exists but quality is poor check section "Bad Image Quality"

Front camera bad image quality troubleshooting

Troubleshooting flow


Bad image quality
Check & adjust display contrast
protection window Check if protection window is faulty, change if needed
No
Image OK?
Dirt or dots in image
Yes
Check & clean dirt on protection window or between window & camera
Image OK?
No
Take uniform white test image, if black spots or dark areas exist, change camera
No
Blurred image
Yes
Check & clean dirt on protection window or between window & camera
Image OK?
No
Try to change camera due to misfocused optics
No
Viewfinder not responding correctly to color scene change
Yes
Change camera
Image OK?
No
See hardware fault finding tree
No
Data errors in image
Yes
See hardware fault finding tree
No
Analyze general image quality by using example images, change camera module if quality is unusual

9 — System Module

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Baseband description

System module block diagram

RM-56 Transceiver consists of two Blocks, Upper Block and Lower Block. Upper Block consists of two PWBs, namely Upper PWB Module- and UI Module. Lower block consists of Engine (BB/RF) PWB Module and numeric keyboard.

The UI Module is connected via board-to-board connector to the Upper PWB Module. The Upper block is connected to the Lower Block (BB/RF module) via a 40-pin connector and a main flex. Another flex, namely side key flex is connected to Engine Module via 7-pin connector. Side key flex includes side key domes for Volume-, POC- and Camera-key.

BB parts are on the backside of the Engine Module. RF, BT and FM parts are on the topside of the Engine Module. Accessories and charger can be connected via the Pop-Port connector and the charger connector at the bottom of the phone.

UI Module consists of function keyboard and LEDs for keyboard backlighting.

Upper PWB Module consists of Display, Earpiece and connectors to UI Module and Engine Module.

Note: In this description, user interface HW (UI HW) covers display, camera, keyboard and keyboard backlight.

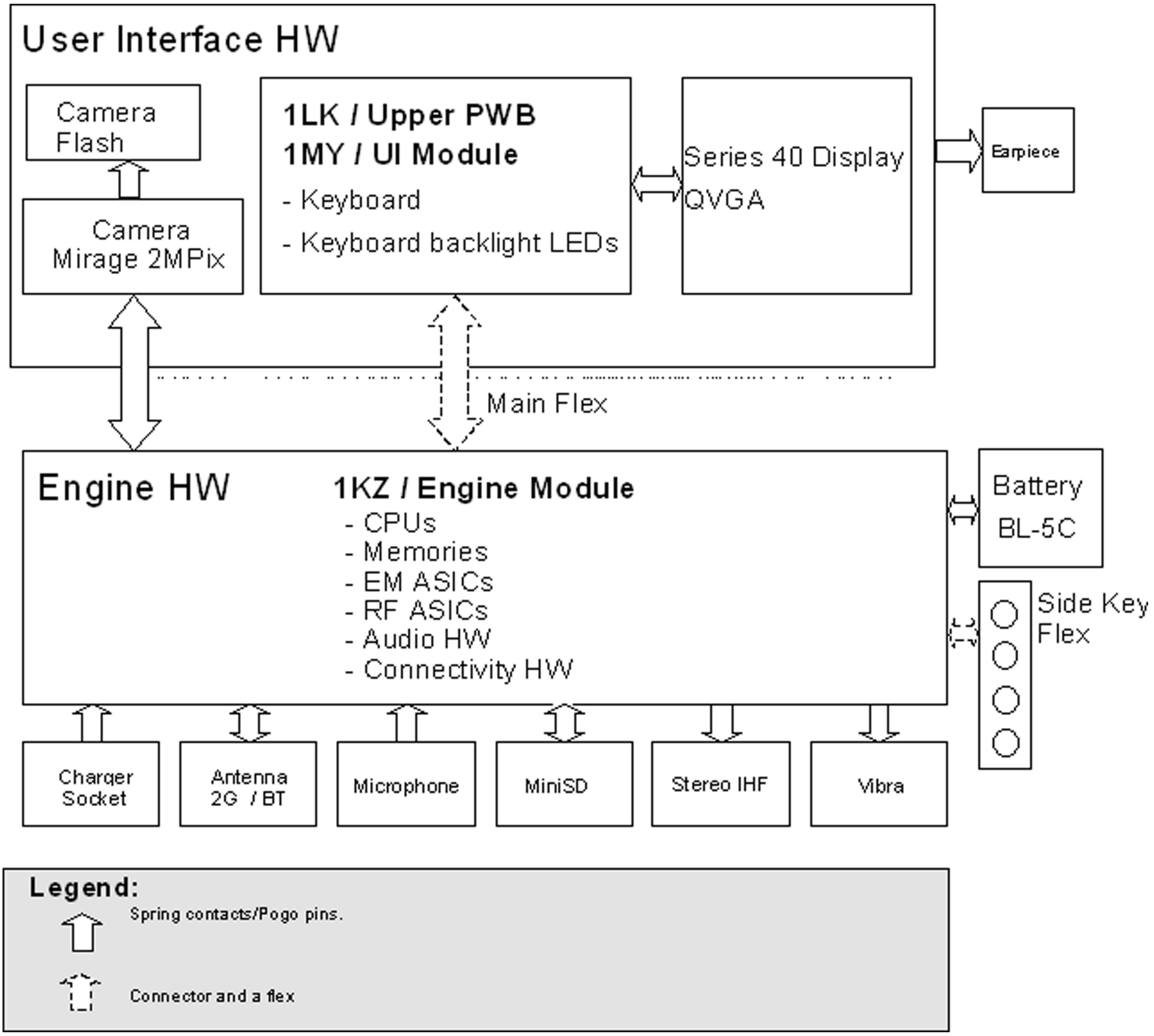

User Interface HW
Camera Flash
Camera Mirage 2MPix
1LK / Upper PWB
1MY / UI Module
- Keyboard
- Keyboard backlight LEDs
Series 40 Display QVGA
Earpiece
Main Flex
Engine HW
1KZ / Engine Module
- CPUs
- Memories
- EM ASICs
- RF ASICs
- Audio HW
- Connectivity HW
Battery BL-5C
Side Key Flex
Charger Socket
Antenna 2G / BT
Microphone
MiniSD
Stereo IHF
Vibra
Legend:
Spring contacts/Pogo pins.
Connector and a flex

Figure 73 System level block diagram

Baseband functional description

Digital baseband consists of ISA based modem and application sections. Modem functionality is in RAPGSM ASIC.

The modem section consists of RAPGSM ASIC and NOR Flash and SDRAM memory as the core. NOR Flash and SDRAM memories are in one package (Combo) RAPGSM supports cellular protocols of GSM (minimum EDGE glass 10, GPRS phase2). Modem SDRAM memory has 128Mbits of memory and NOR flash has 256Mbits of memory. RAPGSM operates with the system clock of 38.4 MHz, which comes from the VCTCXO.

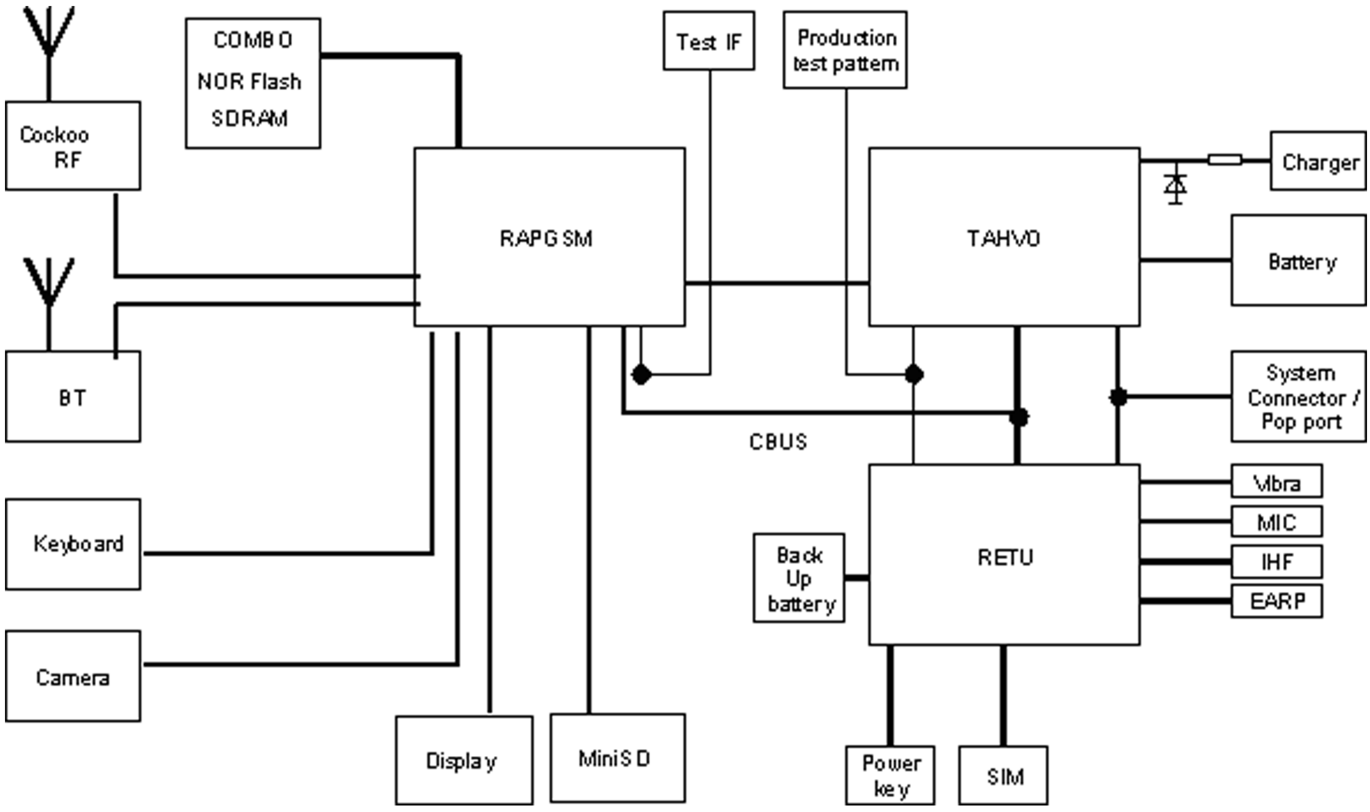

Cockoo RF
COMBO
NOR Flash
SDRAM
Test IF
Production test pattern
RAPGSM
TAHVO
Charger
Battery
BT
System Connector / Pop port
CBUS
Vibra
MIC
IHF
EARP
Keyboard
Back Up battery
RETU
Camera
Display
MiniSD
Power key
SIM

Figure 74 RM-56 Functional block diagram

Absolute maximum ratings

Signal	Min	Nom	Max	Unit	Notes
Battery voltage (idle)	-0.3		+4.5	V	Battery voltage maximum value is specified during charging is active
Battery voltage (Call)			+4.3	V	Battery voltage maximum value is specified during charging is active
Charger input voltage	-0.3		+16V	V	
Back-Up supply voltage	0	2.5	2.7	V	Maximum capacity of the backup power supply assumed to be 4 µAh.

Phone modes of operation

Mode	Description
NO_SUPPLY	(dead) mode means that the main battery is not present or its voltage is too low (below RETU master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over RETU master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off.

Mode	Description
RESET	RESET mode is a synonym for start-up sequence. In this mode certain regulators are enabled and after they and RFClk have stabilized, the system reset (PurX) is released and PWR_ON mode entered. RESET mode uses 32kHz clock to count the REST mode delay (typically 16ms).
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low. In SLEEP mode RETU's regulators VIO, VDRAM, VSIM1, VSIM2, VAUX and Vana are in low quiescent current mode (output voltages still present but regulators will not give as much current out). Other regulators including VR1 supplying system clock oscillator are disabled. In SLEEP mode, TAHVO VCORE SMPS regulator is in low quiescent current mode (if sleep mode is not internally disabled). Linear regulator VOUT state depends on the accessory connected to the system connector (Pop-Port), if there is any.
FLASHING	FLASHING mode is for SW downloading.

Voltage limits

Parameter	Description	Value
VMSTR	Master reset threshold (RETU)	2.2V (typ.)
VMSTR+	Threshold for charging, rising (TAHVO)	2.1V (typ.)
VMSTR-	Threshold for charging, falling (TAHVO)	1.9V (typ.)
VCOFF+	Hardware cutoff (rising)	2.9V (typ.)
VCOFF-	Hardware cutoff (falling)	2.6V (typ.)
SWCOFF	SW cutoff limit	~3.2V

The master reset threshold controls the internal reset of Retu / (Tahvo). If battery voltage is above VMSTR, Tahvo's charging control logic is alive. Also, RTC is active and supplied from the main battery. Above VMSTR, Tahvo allows the system to be powered on although this may not succeed due to voltage drops during start up. SW can also consider battery voltage too low for operation and power down the system.

Power key

The system boots up when power key is pressed (adequate battery voltage, VBAT, present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). Power on key is connected to Retu ASIC via PWRONX signal.

Power distribution

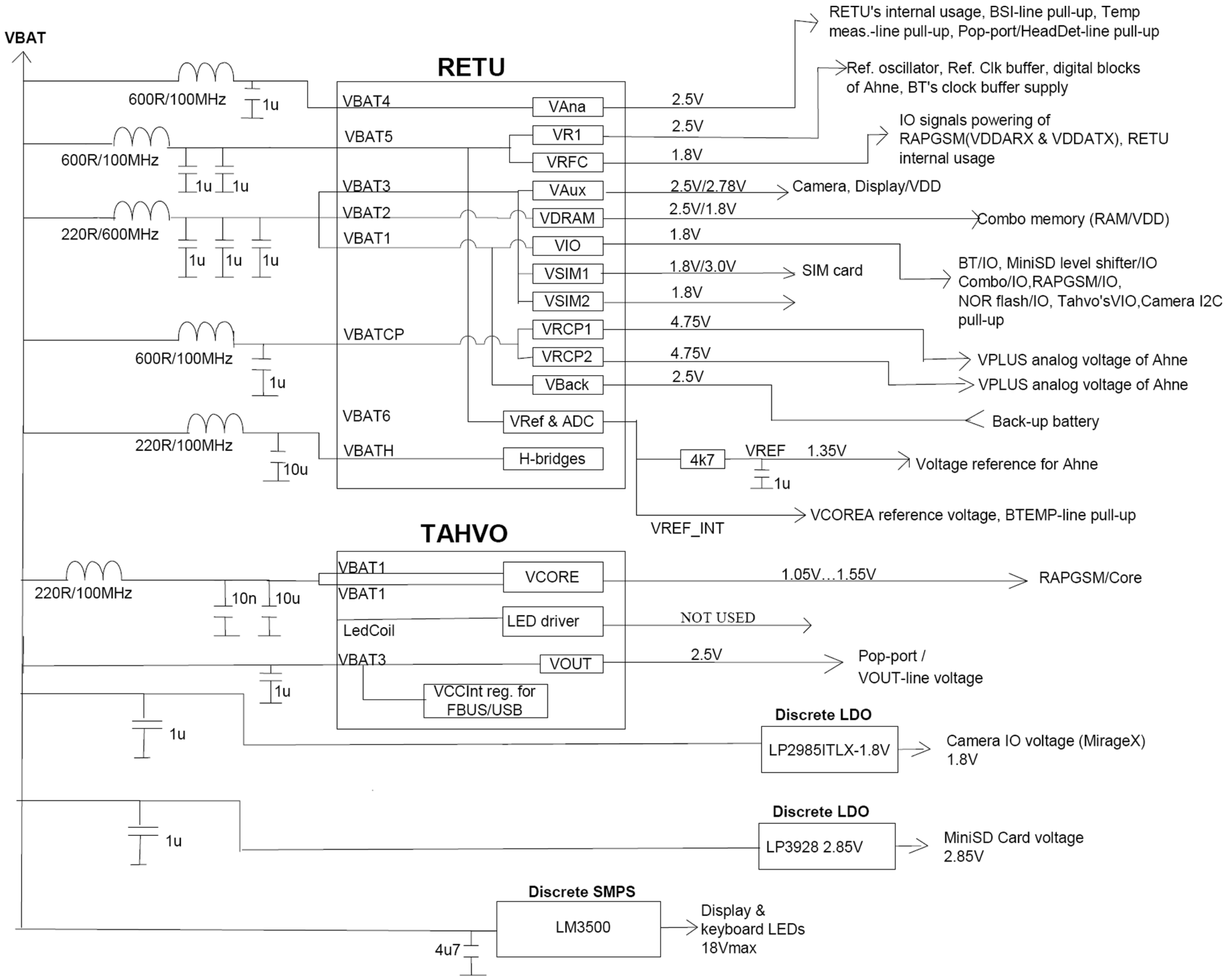

VBAT
RETU
600R/100MHz
1u
600R/100MHz
1u
1u
220R/600MHz
1u
1u
1u
600R/100MHz
1u
220R/100MHz
10u
VBAT4
VBAT5
VBAT3
VBAT2
VBAT1
VBATCP
VBAT6
VBATH
VAna
VR1
VRFC
VAux
VDRAM
VIO
VSIM1
VSIM2
VRCP1
VRCP2
VBack
VRef & ADC
H-bridges
2.5V
2.5V
1.8V
2.5V/2.78V
2.5V/1.8V
1.8V
1.8V/3.0V
1.8V
4.75V
4.75V
2.5V
RETU's internal usage, BSI-line pull-up, Temp meas.-line pull-up, Pop-port/HeadDet-line pull-up
Ref. oscillator, Ref. Clk buffer, digital blocks of Ahne, BT's clock buffer supply
IO signals powering of RAPGSM(VDDARX & VDDATX), RETU internal usage
Camera, Display/VDD
Combo memory (RAM/VDD)
SIM card
BT/IO, MiniSD level shifter/IO Combo/IO,RAPGSM/IO, NOR flash/IO, Tahvo'sVIO,Camera I2C pull-up
VPLUS analog voltage of Ahne
VPLUS analog voltage of Ahne
Back-up battery
4k7
VREF
1.35V
1u
Voltage reference for Ahne
VREF_INT
VCOREA reference voltage, BTEMP-line pull-up
TAHVO
220R/100MHz
10n
10u
VBAT1
VBAT1
LedCoil
VBAT3
VCORE
LED driver
VOUT
VCCInt reg. for FBUS/USB
1u
1.05V...1.55V
RAPGSM/Core
NOT USED
2.5V
Pop-port / VOUT-line voltage
1u
Discrete LDO
LP2985ITLX-1.8V
Camera IO voltage (MirageX) 1.8V
1u
Discrete LDO
LP3928 2.85V
MiniSD Card voltage 2.85V
Discrete SMPS
LM3500
4u7
Display & keyboard LEDs 18Vmax

Figure 75 Power distribution diagram

Power supply components:

- RETU
- TAHVO
- BT LDO
- camera LDO
- MiniSD LDO
- camera flash
- backlight SMPS

All the above are powered by the main battery voltage.

Battery voltage is also used on the RF side for power amplifiers (GSM PA) and for RF ASIC Ahne.

Discrete power supplies are used to generate 1.8V for the camera module, 2.85V for MiniSD card and max. 18V for backlight LEDs.

The device supports both 1.8V/3V SIM cards which are powered by RETU / VSIM1. RETUs VSIM2 is not used. USB accessories which needs power from the device are powered by TAHVO / VOUT.

Because LED driver in TAHVO is not used, the external SMPS is used instead. External LED SMPS is still controlled by TAHVO and powered by battery voltage.

System power-up

After inserting the main battery, regulators started by HW are enabled. SW checks, if there is some reason to keep the power on. If not, the system is set to power off state by watchdog. Power up can be caused by the following reasons:

- Power key is pressed
- Charger is connected
- RTC alarm occurs
- MBUS wake-up

After that:

- Retu activates sleep clock and VANA, VDRAM, VIO and VR1 regulators.
- Voltage appearing at Retu’s RSTX pin is used for enabling Tahvo ASIC.
- Tahvo enables VCORE regulator and its internal RC-oscillator (600kHz).
- VCTCXO regulator is set ON and RF clock (main system clock) is started to produce.
- Retu will release PURX ~ 16ms after power up is enabled (the RF clock is then stable enough).
- Synchronizing clock (2.4MHz) for Tahvo is started to be produced. After PURX is released and two rising edges of 2.4MHz synchronous clock have been detected in SMPSClk input Tahvo is starting to use that instead of 600kHz internal RC-oscillator.
- HW start-up procedure has been finalized and the system is up and running. Now it is possible for SW to switch ON other needed regulators.

Clocking scheme

In BB5.0, two main clocks are provided to the system: 38.4MHz RF clock produced by VCTCXO in RF section and 32.768kHz sleep clock produced by RETU with an external crystal.

RF clock is generated only when VCTCXO is powered on by RETU regulator. Regulator itself is activated by SleepX signals from RAP3G. When both CPUs are on sleep, RF clock is stopped.

RF clock is used by RAPGSM that then provides (divided) 19.2MHz SysClk further to OMAP. RAPGSM has internal PLLs which then create clock signals for other peripheral devices/interfaces like SD card, SIM, CCP, I2C and memories.

32k Sleep Clock is always powered on after startup. Sleep clock is used by RAPGSM.

SMPS Clk is 2.4MHz clock line from RAPGSM to Tahvo used for switch mode regulator synchronizing in active mode. In deep sleep mode, when VCTCXO is off, this signal is set to '0'-state.

BT Clk is 38.4MHz signal from Ahne ASIC to BT module.

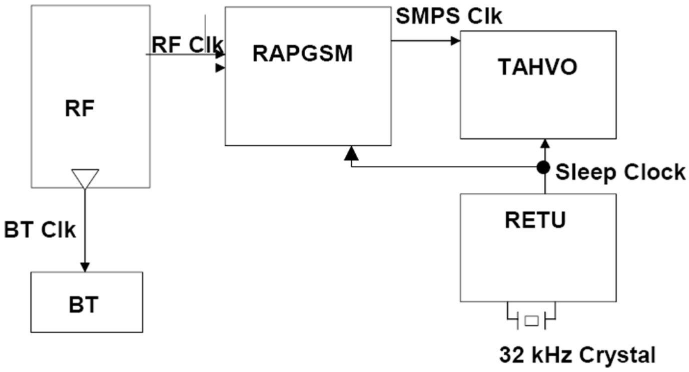

RF
RF Clk
RAPGSM
SMPS Clk
TAHVO
Sleep Clock
RETU
BT Clk
BT
32 kHz Crystal

Figure 76 Clocking scheme

Bluetooth

Bluetooth provides a fully digital link for communication between a master unit and one or more slave units. The system provides a radio link that offers a high degree of flexibility to support various applications and product scenarios. Data and control interface for a low power RF module is provided. Data rate is regulated between the master and the slave.

The device Bluetooth is based on BC4 ROM1.0RDL BT chip.

The UART1 interface handles the transfer of control and data information between RAPGSM and the BT system (BC4).

The PCM interface is used for audio data transfer between RAPGSM and the BT system (BC4).

USB

USB (Universal Serial Bus) provides a wired connectivity between host PC and peripheral devices.

USB is a differential serial bus for USB devices. USB controller (RAPGSM) supports USB specification revision 2.0 with full speed USB (12 Mbps). The device is connected to the USB host through the Pop-Port™ connector. The USB bus is hot plugged capable, which means that USB devices may be plugged in/out at any time.

The device's USB consists of data interface between RAPGSM and USB/FBUS transceiver module located in Tahvo, control interface between RAPGSM and Tahvo and external interface between Tahvo and Pop Port connector. USB and FBUS have multiplexed interface between ASICs

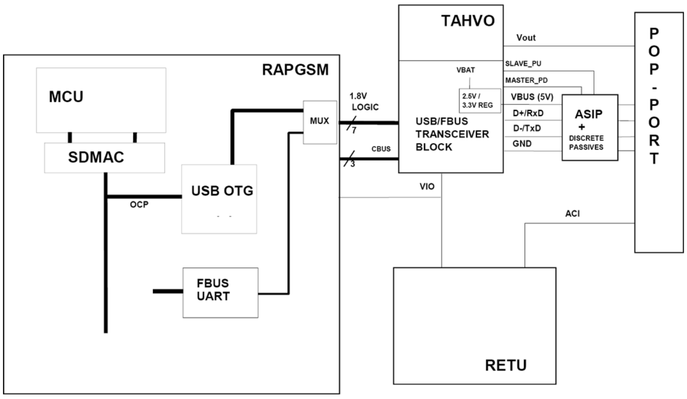

TAHVO
Vout
RAPGSM
MCU
SDMAC
VBAT
SLAVE_PU
MASTER_PD
2.5V / 3.3V REG
VBUS (5V)
1.8V LOGIC
MUX
7
D+/RxD
D-/TxD
GND
USB/FBUS TRANSCEIVER BLOCK
ASIP + DISCRETE PASSIVES
CBUS
3
USB OTG
OCP
VIO
ACI
FBUS UART
RETU
POP-PORT

Figure 77 USB

Hall sensor

HALL sensor is used to monitor the position of the upper block in slide construction.

The function of a Hall sensor is based on the physical principle of the Hall effect. Hall voltage is generated over sensor when magnetic field traverses the sensor.

There is an integrated comparator and switches in Hall switches. When sensor is in magnetic field, switch is closed and output is connected to GND.

Hall sensor detects the slide position. There is a magnet in slide mechanics under the display module and when the slide is closed Hall sensor is in magnetic field. Sensor's output is connected to GENIO44. Output is pulled up to VIO through 100k ohm resistor. Hall sensor is supplied by VAUX regulator.

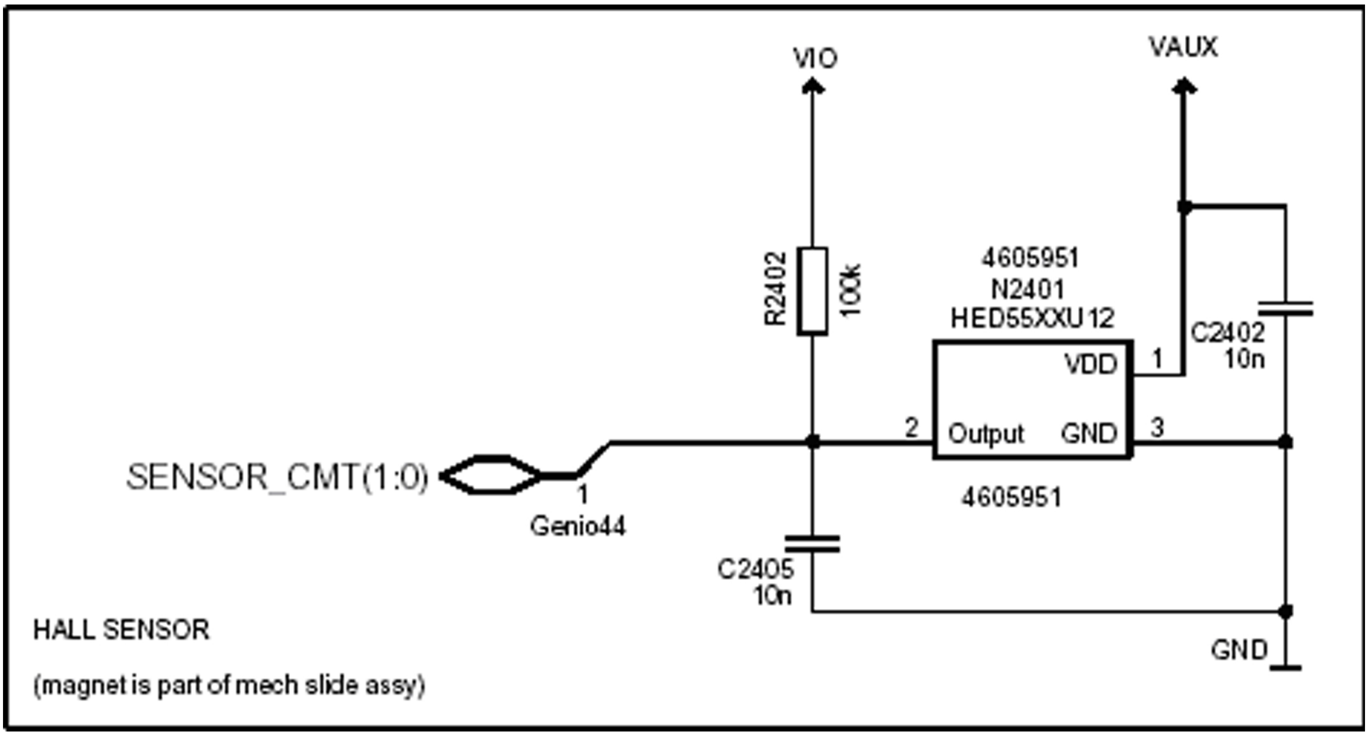


Figure 78 Hall sensor connection

FM radio

The FM radio circuitry is implemented using a highly integrated radio TEA5761UK. The MCU SW controls the FM radio circuitry through I2C interface.

The analogue single ended stereo output, VAFL and VAFL, are fed to the Retu's MIC3 microphone input through 100nF capacitors.

The antenna of the FM Radio is created with the headset. The wires of the headset are used as poles of the antenna.

Camera

The device uses Mirage2MP camera module. Mirage2MP is 2Mpixel camera with sensor resolution of 1600 x 1200. Figure 34 shows the block diagram where CCP bus is used to transfer image data from camera to the engine.

Bi-directional control bus is SW implemented I2C interface. External camera regulator (VIO level 1.8V) N3302 powers digital parts of the camera.

Digital control CAMVCTRL enables the regulator. VAUX power rail is for powering analog parts of the camera.

CAM_ENABLE_X signal (Vctrl) is used for activating the camera module. When Vctrl is turned on High level, the camera module enters the operation mode. When Vctrl is turned on Low level, the camera module enters the power off mode. CAMCLK signal feeds system clock for camera module.

Camera flash

The device camera includes a flash LED providing better lighting condition in darker environments. The same LED is also used as a video light.

The flash is located in C-cover assembly, beside the back camera. The operating range of the flash is approximately 1 m (~22 Lux) and 1.5 m (~9 Lux).

The connection between the engine PWB and the flash is implemented with pogo pins. The flash has four white LEDs connected in series in one module.

The module also includes a lens with its plastic housing. The dimensions of the FLED are 6.5 x 7.5 x 3.5 mm. Flash requires external flash led driver.

Driver increases flash voltage up to 20V and current up to 80mA. If flash is used as camera flash, it is enabled using strobe signal. Then driver is enabled and FET V3301 is connected and current through flash LEDs is ~80mA. When flash is used as a video light, only driver is enabled using GENIO, and current through LEDs is ~5mA.

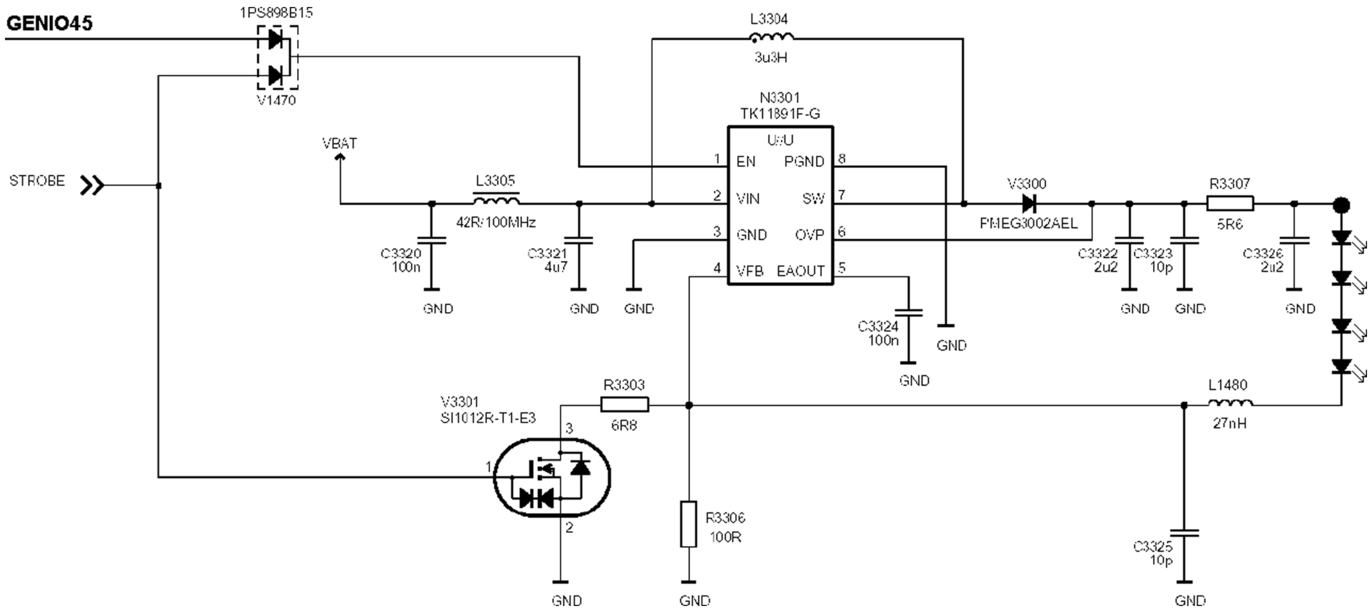

GENIO45
1PS898B15
V1470
L3304
3u3H
N3301
TK11891F-G
U/U
STROBE
VBAT
L3305
42R/100MHz
C3320
100n
C3321
4u7
GND
GND
GND
1 EN
2 VIN
3 GND
4 VFB
PGND 8
SW 7
OVP 6
EAOUT 5
V3300
PMEG3002AEL
R3307
5R6
C3322
2u2
C3323
10p
C3326
2u2
GND
GND
GND
C3324
100n
GND
GND
L1480
27nH
V3301
SI1012R-T1-E3
R3303
6R8
3
1
2
R3306
100R
C3325
10p
GND
GND
GND

Figure 79 Camera flash

IrDA

The device supports data connectivity via the Infra Red link. The IR interface is implemented using GENIO port of RAPGSM.

Main external component is the IR module. The data rate supported will be 1.152Mbit. The maximum operating distance of IrDA is approximately 1meter.

IR module is TFDU5307-TR3. It contains Rx part and TX part. Main components of Rx part are photo diode and amplifier and comparator.

Photo diode conducts when it receives IR light. signal from photo diode is amplified and compared and fed to RxD output. Tx part contains transmitter LED.

LED is controlled by TxD input. Anode of IR LED is connected directly to VBAT via 4.7 ohms current limit resistor R2600.

Supply voltage of IR module is connected to VAUX. VIO is connected to Vlogic pin and it defines I/O voltages of IR module. The shut down pin SD can power off the module.

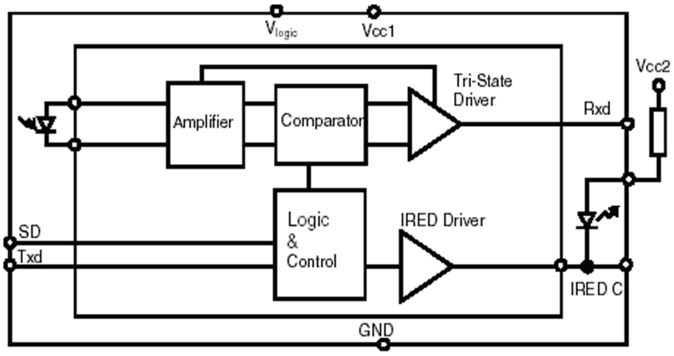

V_logic
Vcc1
Vcc2
Tri-State
Driver
Rxd
Amplifier
Comparator
Logic
&
Control
IRED Driver
SD
Txd
IRED C
GND

Figure 80 IR module block

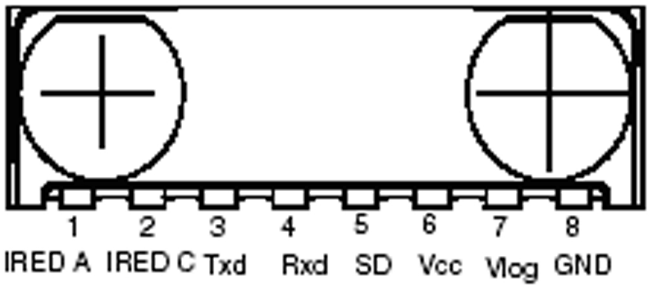

1
2
3
4
5
6
7
8
IRED A
IRED C
Txd
Rxd
SD
Vcc
Vlog
GND

Figure 81 IR module pin ordering

Backup battery

Backup battery

When the main battery is not attached Retu ASIC goes in backup mode using Back-Up battery that supplies voltage to RTC in Retu ASIC.

During backup mode RTC Watch Dog is running and switches the ASIC into dead mode if the RTC has been running for max 1 hour in backup mode.

CBUS interface

CBUS is a "main" system control bus in BB5.0. RAPGSM controls the functionality of Retu and Tahvo ASICs with CBUS.

CBUS is a four-wire half-duplex master-slave interface. In BB5.0 CBUS clock frequency is 2.4 MHz.

FBUS

USB and FBUS have multiplexed interface between Tahvo and RAPGSM.

ACI interface

ACI interface

The ACI (Accessory Control Interface) is a point-to-point, bi-directional, single line serial bus.

It has two main features: the insertion and removal detection of an accessory device and acting as a data bus between phone and accessory, intended for control purposes. A third function of ACI is to identify and authenticate the accessory.

VOUT interface

VOUT interface

Accessory power is supplied by VOUT, a linear low drop-out regulator in Tahvo providing 2.5V at 90mA maximum when active (0.5mA in sleep).

ACI data passes to and from Tahvo via the HeadDet line. Tahvo connects HeadDet to MBUS for RAPGSM to access.

Charger interface

Charging control and charge switch are in TAHVO.

The significant voltage limits are listed below:

- VMSTR Master reset threshold (RETU) 2.2V (typ.)
- VMSTR+ Threshold for charging, rising (TAHVO) 2.1V (typ.)
- VMSTR- Threshold for charging, falling (TAHVO) 1.9V (typ.)
- VCOFF+ Hardware cutoff (rising) 2.9V (typ.)
- VCOFF- Hardware cutoff (falling) 2.6V (typ.)
- SWCOFF SW cutoff limit ~3.2V

Charging is controlled by different blocks depending on the situation; If battery is totally empty, the charging is controlled by CHACON block in TAHVO and the battery is first charged with constant current is until the voltage rises above certain limit (VMSTR+).

When battery voltage rises over TAHVO internal VMSTR+ limit (and stays over the VMSTR- limit), the charging logic is alive.

The digital part of TAHVO takes care of the charging and PWM charging is done until PURX is released. After this SW starts to control the charging. There is a thermal protection in TAHVO.

If the temperature rises too high and the thermal protection is activated, TAHVO goes to protection mode.

MiniSD interface

MiniSD interface

The MiniSD card interface is electrically and functionally compatible with SD card interface. SD card interface is a 1-bit serial IF connected to RAPGSM.

IF includes 1.8V-2.85V level shifter and 2.85V LDO regulator (combined into one package) and an SD ASIP. Card detection is implemented by using the reader's internal switch which is connected to RAPGSM's GenIO46

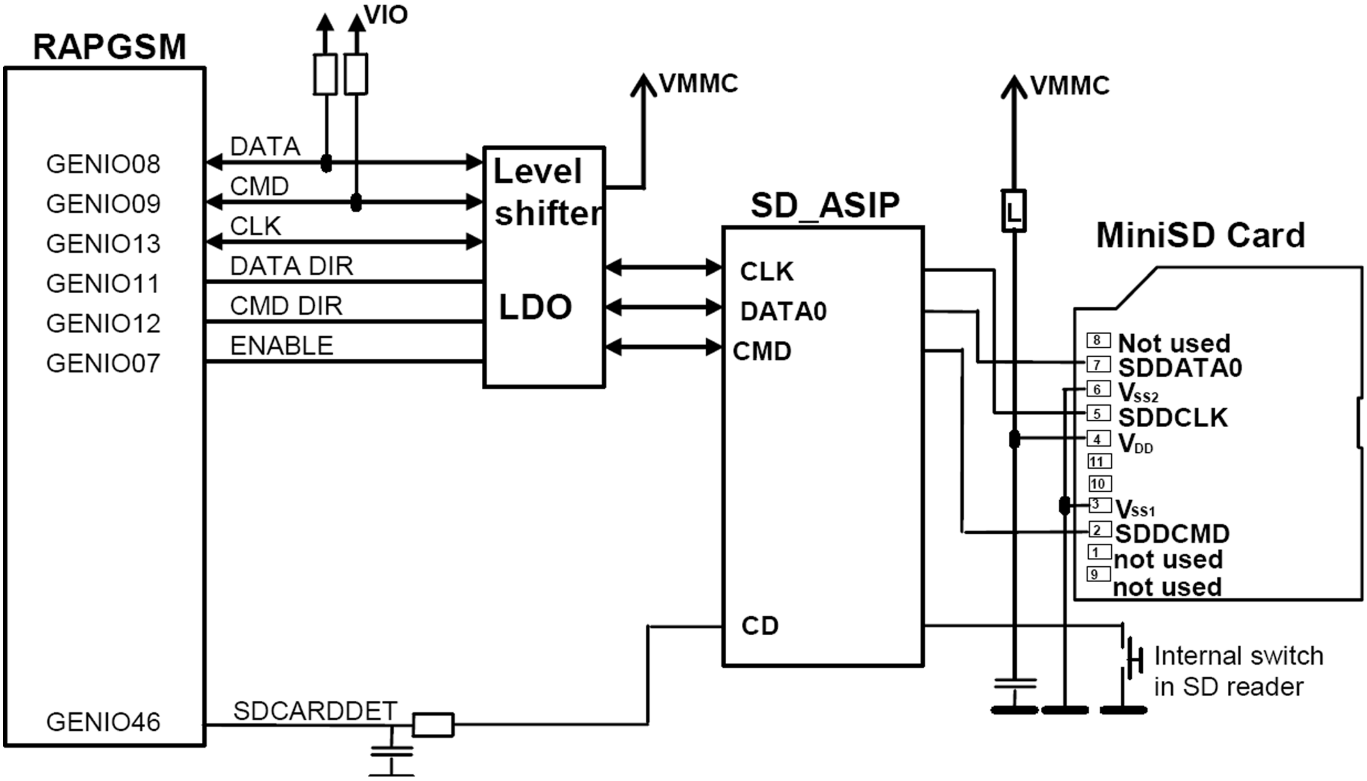
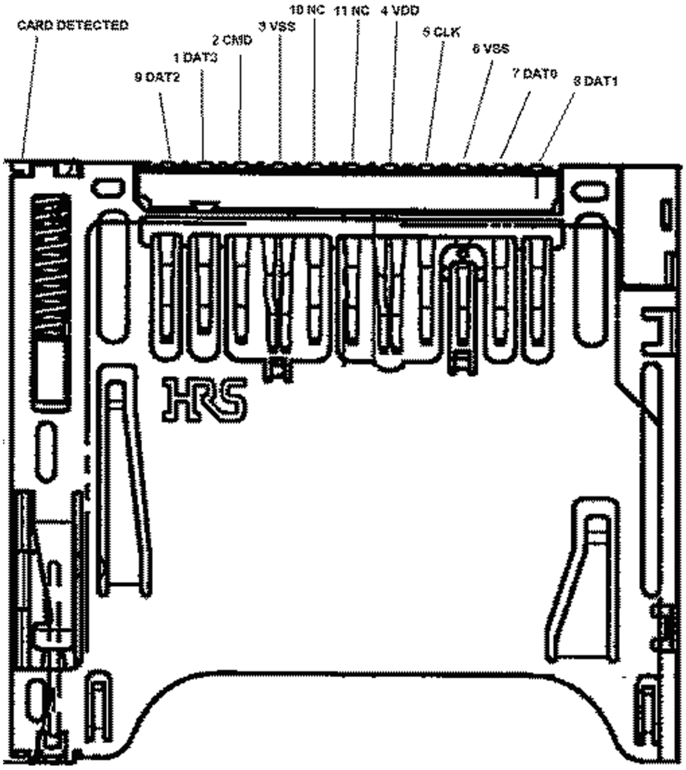

RAPGSM
VIO
VMMC
VMMC
GENIO08
GENIO09
GENIO13
GENIO11
GENIO12
GENIO07
GENIO46
DATA
CMD
CLK
DATA DIR
CMD DIR
ENABLE
SDCARDDET
Level shifter
LDO
SD_ASIP
CLK
DATA0
CMD
CD
L
MiniSD Card
8 Not used
7 SDDATA0
6 Vss2
5 SDDCLK
4 VDD
11
10
3 Vss1
2 SDDCMD
1 not used
9 not used
Internal switch in SD reader

Figure 82 Mini SD interface

Table 13 MiniSD Interface

Pin	Signal	I/O	Engine connection		Notes
1	RSV		NC	NC	Reserved for future use
2	CMD	<->	RAPGSM	Genio09	Command/Response
3	Vss1		GND		Ground
4	VDD	<-	Ext.regulator	VMMC	VMMC, supply voltage 2.85V (Max 150mA)
5	CLK	<-	RAPGSM	Genio13	External clock for the MMC card, Max 25 MHz
6	Vss2		GND		Ground
7	DAT	<->	RAPGSM	GENIO08	Bi-directional data bus
A	SDCARDDET	->	RAPGSM	Genio46	Card detect

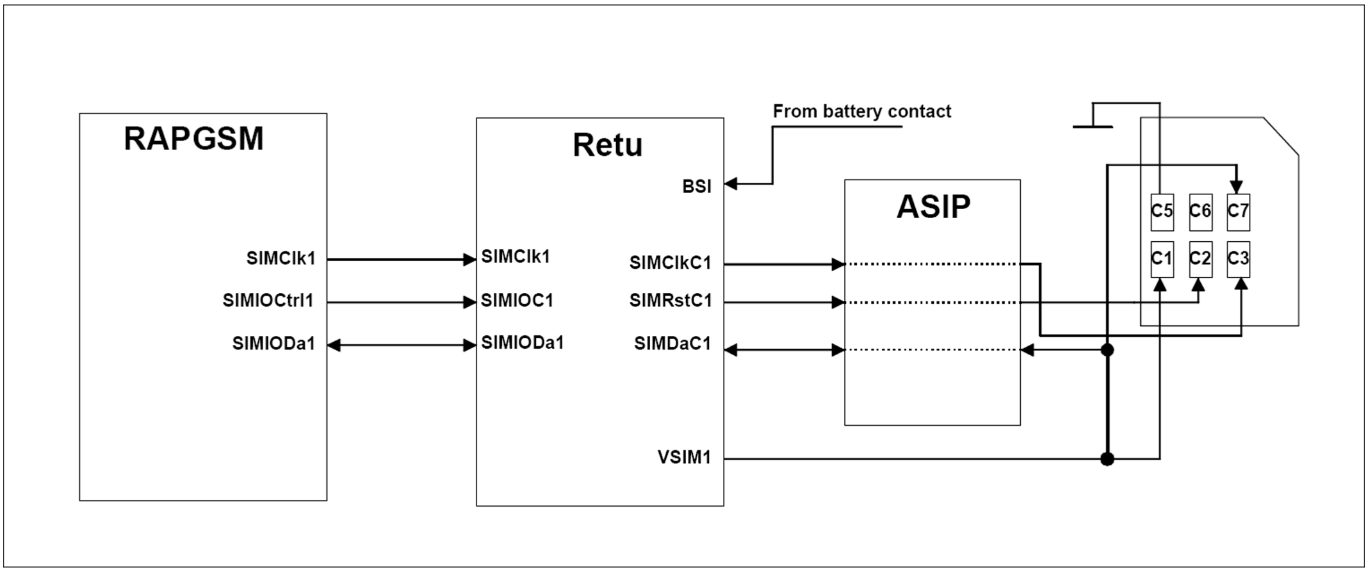

CARD DETECTED
9 DAT2
1 DAT3
2 CMD
3 VSS
10 NC
11 NC
4 VDD
5 CLK
6 VSS
7 DAT0
8 DAT1
HRS

SIM/USIM

The device has one SIM (Subscriber Identification Module) interface and the SIM card locates under the battery.

SIM interface consists of internal interface between RAPGSM and Retu and an external interface between Retu and SIM contacts.

SIM interface functionality is located in RAPGSM while Retu takes care of power up/down, card detection, ATR counting and level shifting. Retu external SIM IF connections and electrical characteristics between ASICs are shown in the picture.


RAPGSM
SIMClk1
SIMIOCtrl1
SIMIODa1
Retu
BSI
SIMClk1
SIMIOC1
SIMIODa1
SIMClkC1
SIMRstC1
SIMDaC1
VSIM1
From battery contact
ASIP
C5
C6
C7
C1
C2
C3

Retu handles SIM card detection and the detection method is based on battery removal trough the BSI line.

Due to location of the SIM card, removal of the battery causes quick power down of the SIM IF. The Retu SIM1 interface supports both the 1.8V and 3.0V SIM cards.

SIM interface voltage is first 1.8V when the SIM card is inserted and if the card does not response to the ATR (answer to reset) 3V interface voltage is used.

The data communication between the card and the phone is asynchronous half duplex and the clock supplied to cards is 1-5MHz, which is 3.2MHz by default (in GSM system).

The data baud rate is SIM card clock frequency divided by 372 (by default), 64, 32 or 16.

Battery interface

The battery interface supports the NMP 3-pole battery interface. The interface consists of three connectors: VBAT, BSI and GND.

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

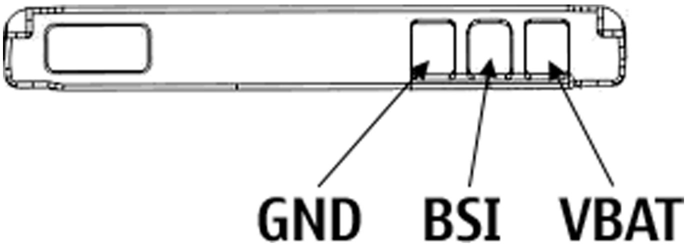


Figure 83 Battery pin order

Battery temperature is estimated by measuring separate battery temperature NTC via the BTEMP line, which is located on the transceiver PWB, at a place where the phone temperature is most stabile.

For service purposes, the device SW can be forced into local mode by using pull down resistors connected to the BSI line.

User interface

Display interface

Display module mechanical concept

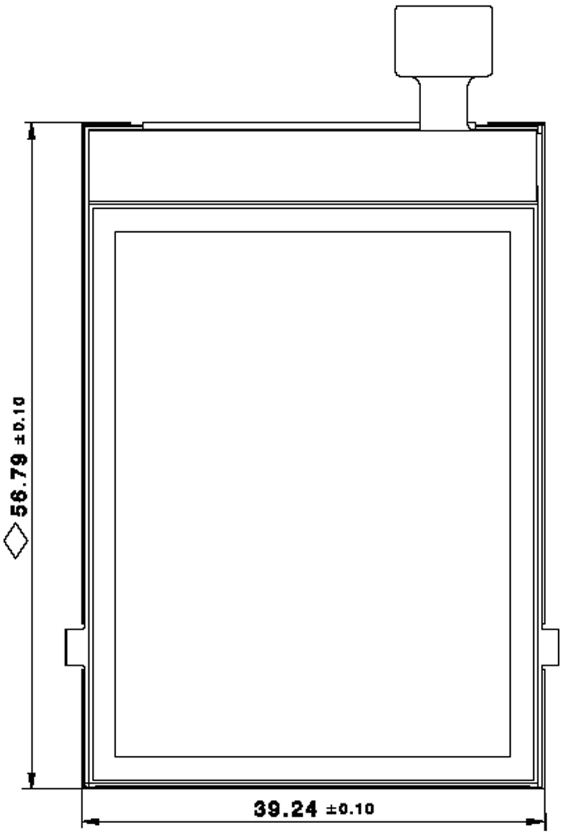


Figure 84 LCD module

Display features:

- QVGA resolution, 320x240
- Active area is 33mmx44mm, 2.2”
- Partial display function Power saving by pausing display process on part of the screen.
- Built-in RAM capacity 320rows×240lines×18bit

Display is controlled via MeSSi interface by RAPGSM. All MeSSi signals are going through the EMC filtering ASIPs.

Logic power supply (1.65V-1.95V) is connected to VIO and driver power supply (2.3V – 2.9V) is connected to VAUX.

Keyboard

The device keyboard consists of 25 separate keys.

The keyboard is partitioned in three separate keyboards: upper (9 function keys), lower (12 numeric keys) and side keys (4 keys; two for volume, POC and camera).

The keyboard is implemented as a matrix keyboard, which is connected directly to the dedicated keyboard GENIO lines.

The keymatrix has six rows and four columns. The voice key on the main PWB and the navigation key are connected to the same keymatrix.

Table 14 Keyboard matrix

Genios		33	34	35	40	41
	Lines	COL0	COL1	COL2	COL3	COL4
36	ROW0	RightSK	Up	LeftSK	1	2
37	ROW1	Right	Menu/select	Left	4	5
39	ROW2	End	Down	Send	7	8
32	ROW3	POC	Cam	3	*	0
38	ROW4	Vol down	Vol up	6	9	#

Backlights

Backlights

There are two white LEDs for upper keyboard backlights and three white LEDs for lower keyboard backlight.

The display includes four white LEDs for display backlights inside of the display module. Voltage source for backlights is implemented using an external white LED driver.

The driver increases battery voltage up to 18V. Driver is enabled by Tahvo’s PWM300 output. PWM300 is SW controlled pulse width modulated(PWM) output.

Display backlight current is monitored using LED driver feedback input. Keyboards backlight LEDs are connected directly to GND.

Lower keyboard backlights can be switched off separately via digital control. Switch is implemented and current is stabled by NPN transistor controlled by GENIO0.

ASICs

RAPGSM ASIC

RAPGSM is a GSM EDGE chip (modem ASIC) with lots of peripheral features.

The subsystems are combined at the glue level;

- processor subsystem (PSS) that includes ARM926 MCU as a main processor
- Lead3 PH3 DSP and related functions
- ASIC clock and reset control
- MCU peripherals e.g. CBUS IF, USB IF and SIM IF
- DSP peripherals e.g. speech codec
- Clock slicer. It is a block that gets low amplitude differential sinusoidal clock wave RfClkP & RfClkN 38.4MHz) in and gives an accurate square wave out (SYSCLK 19.2MHz).
- RF Codec that includes ADC and DAC converters for the RF signal

Retu EM ASIC

Retu EM ASIC includes the following functional blocks:

- Start up logic and reset control
- Charger detection
- Battery voltage monitoring
- 32.768 kHz clock with external crystal
- Real time clock with external backup battery
- SIM card interface
- Stereo audio codecs and amplifiers
- A/D converter
- Regulators
- Vibra interface
- Digital interface (CBUS)

Tahvo EM ASIC

TAHVO Energy Management ASIC is intended for energy management control, supply voltage generation and charge control of mobile phone.

Device memories

RAPGSM memories NOR flash and SDRAM

Modem memory consists of 128Mbit SDRAM and 256 Mbit NOR flash memory.

SDRAM is dynamic memory for ISA SW. NOR is used for ISA SW code and PMM data and CDSP SW code.

16-bit wide SDRAM interface consists of SDRAM controller from ARM, DCDL/DLLs and wrapper logic. 32-bit wide flash interface is implemented by using EMC module.

SDRAM core voltage (1.8V) is generated from Retu VDRAM and I/O voltage (1.8V) is from VIO. NOR flash uses VIO for both core and I/O voltages.

Audio concept

Audio HW architecture

The functional core of the audio hardware is built around two ASICs: RAPGSM engine ASIC and the mixed-signal ASIC Retu.

Retu provides an interface for the transducers and the accessory connector. Integrated hads free stereo spekers are driven by a D-class audio amplifier TPA2012D2.

There are four audio transducers:

- 7x11 mm dynamic earpiece
- Two 13 mm dynamic speakers
- electret microphone module

In addition to the audio transducers, Retu also provides an output for the dynamic vibra component.

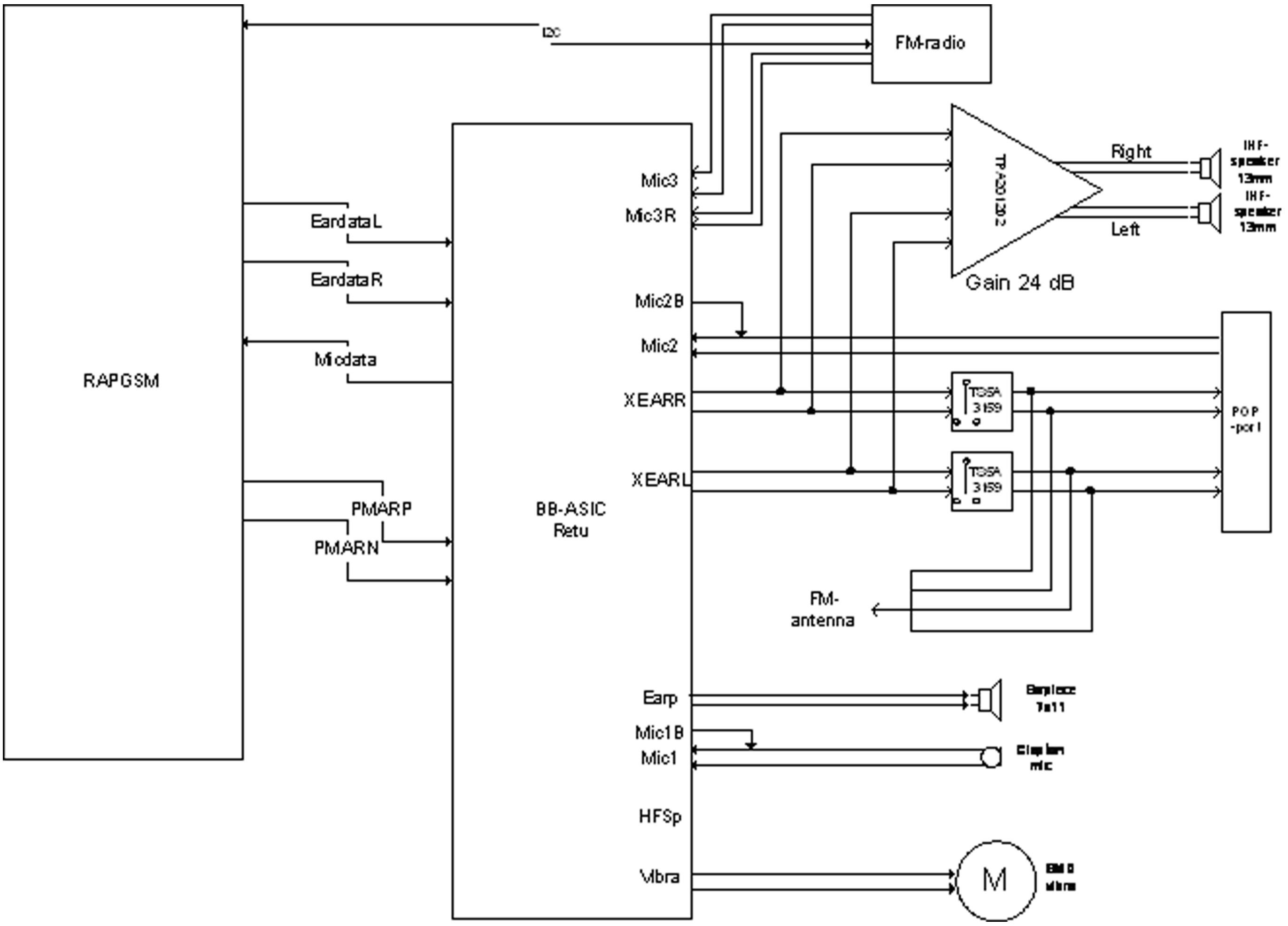

RAPGSM
I2C
FM-radio
Mic3
Mic3R
EardataL
EardataR
Micdata
Mic2B
Mic2
XEARR
XEARL
PMARP
PMARN
BB-ASIC
Retu
TPA2012D2
Right
Left
Gain 24 dB
IHF-speaker 13mm
IHF-speaker 13mm
TSSA 3159
TSSA 3159
POP-port
FM-antenna
Earp
Mic1B
Mic1
HFSp
Vibra
M
Earpiece

Figure 85 Audio block diagram

Internal microphone

Internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes.

An analogue electret microphone is connected to N2200 Mic1P and Mic1N inputs via asymmetric electrical connection.

The microphone is biased by N2200 MicB1 bias voltage output.

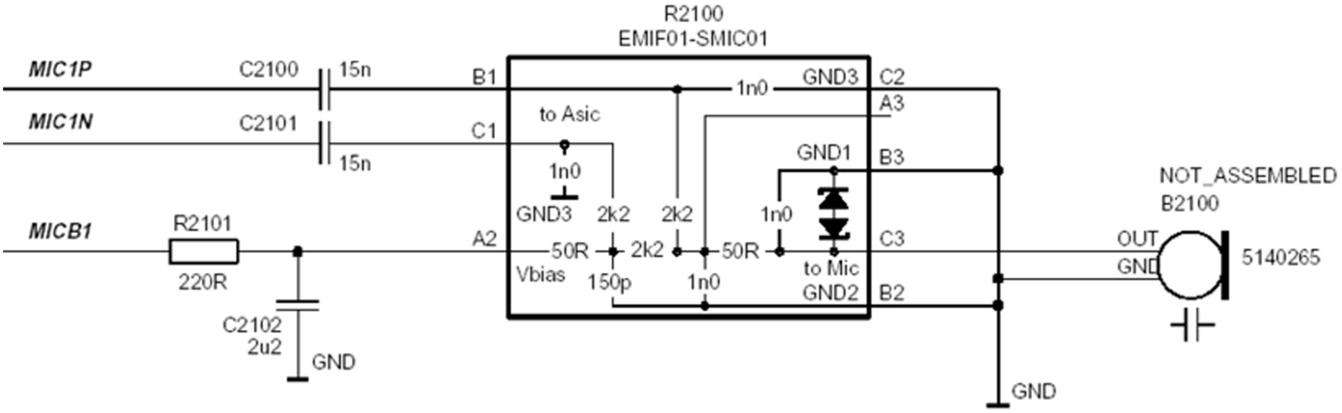

R2100
EMIF01-SMIC01
MIC1P
MIC1N
MICB1
C2100
15n
C2101
15n
R2101
220R
C2102
2u2
GND
B1
C1
A2
to Asic
1n0
GND3
2k2
2k2
1n0
50R
2k2
50R
Vbias
150p
1n0
to Mic
GND2
GND3
GND1
1n0
C2
A3
B3
C3
B2
GND
NOT_ASSEMBLED
B2100
OUT
GND
5140265

Figure 86 Internal microphone circuitry

External microphone

Galvanic accessories are connected to the system connector.

The accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

External microphone circuitry is biased by N2200 MicB2 bias voltage output. The circuitry provides a symmetrical connection for the microphone from the system connector connections, XMICN and XMICP, to N2200 inputs, Mic2P and Mic2N.

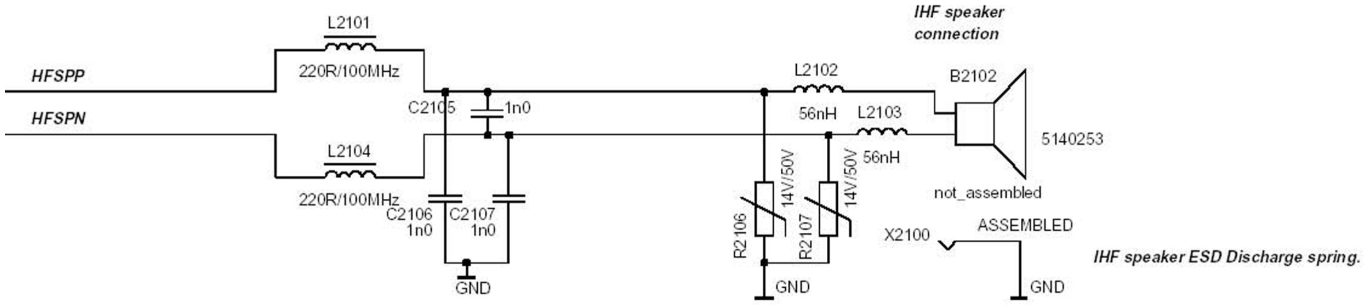

HFSPP
HFSPN
L2101
220R/100MHz
L2104
220R/100MHz
C2105
1n0
C2106
1n0
C2107
1n0
GND
L2102
56nH
L2103
56nH
R2106
14V/50V
R2107
14V/50V
GND
IHF speaker
connection
B2102
5140253
not_assembled
X2100
ASSEMBLED
GND
IHF speaker ESD Discharge spring.

Figure 87 External microphone circuitry (Pop-Port connects to the right side)

Internal earpiece

Internal earpiece is used for the HandPortable (HP) call mode. A dynamic 8mm earpiece capsule is connected to Retu ASIC’s differential output EarP and EarN.

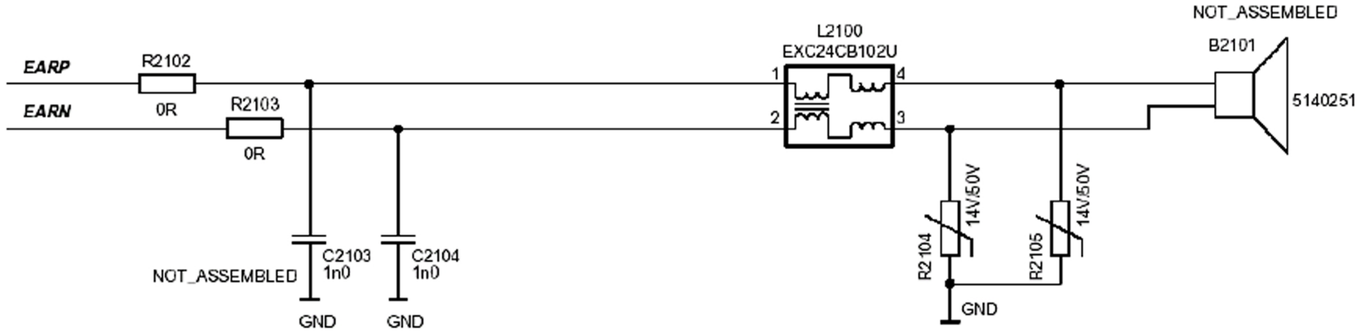

EARP
EARN
R2102
0R
R2103
0R
NOT_ASSEMBLED
C2103
1n0
C2104
1n0
GND
GND
L2100
EXC24CB102U
1
2
3
4
R2104
14V/50V
R2105
14V/50V
GND
NOT_ASSEMBLED
B2101
5140251

Figure 88 Internal earpiece circuitry

Internal speakers

Internal speakers are used for Internal HandsFree (IHF) call mode, ringing tones, FM-radio and music listening.

Two dynamic 13mm speakers are connected to Retu ASIC’s outputs XearR/XearL via stereo D-class IHF amplifier TPA2012D2.

The amplifier has 24 dB fixed gain and it is put to shutdown mode when not in use.

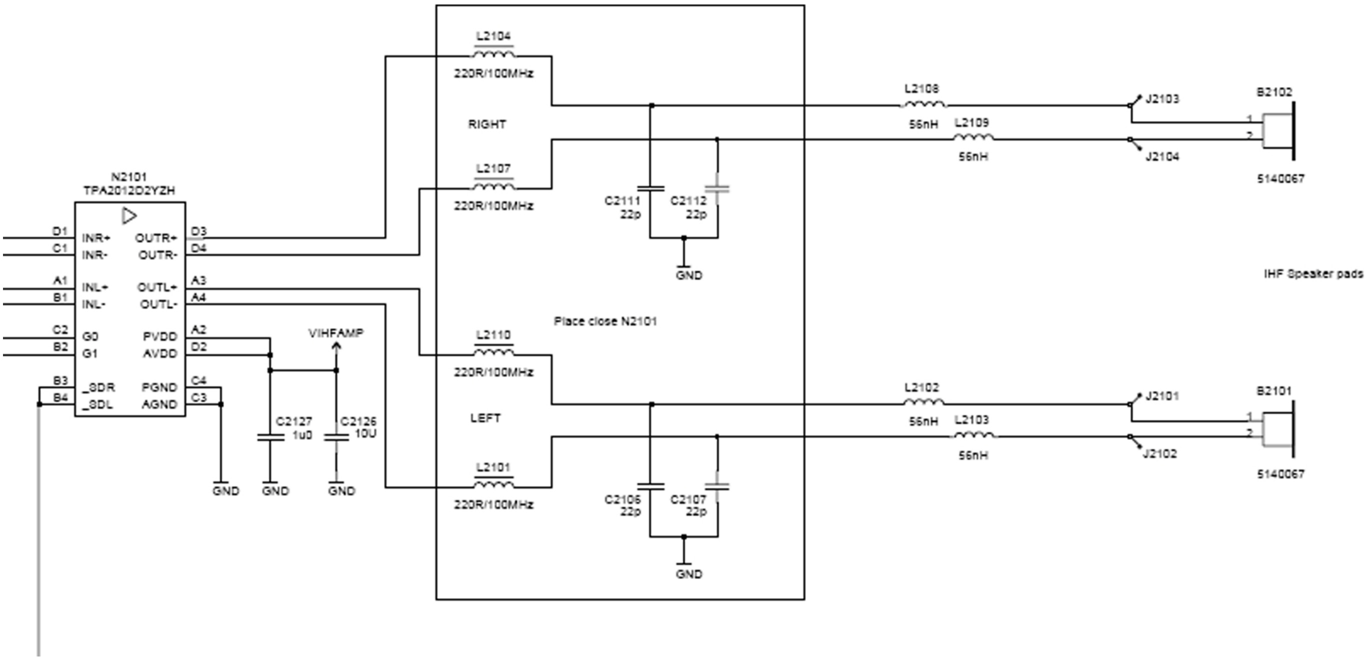

L2104
220R/100MHz
RIGHT
L2107
220R/100MHz
N2101
TPA2012D2YZH
D1
C1
A1
B1
C2
B2
B3
B4
INR+
INR-
INL+
INL-
G0
G1
_SDR
_SDL
OUTR+
OUTR-
OUTL+
OUTL-
PVDD
AVDD
PGND
AGND
D3
D4
A3
A4
A2
D2
C4
C3
VIHFAMP
C2127
1u0
C2126
10U
GND
GND
GND
C2111
22p
C2112
22p
GND
Place close N2101
L2110
220R/100MHz
LEFT
L2101
220R/100MHz
C2106
22p
C2107
22p
GND
L2108
56nH
L2109
56nH
J2103
J2104
B2102
1
2
5140067
IHF Speaker pads
L2102
56nH
L2103
56nH
J2101
J2102
B2101
1
2
5140067

Figure 89 Internal speaker circuitry

External earpiece

All galvanic accessories are connected to the system connector (Pop-Port™).

The accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

Retu ASIC provides two output channels in either single-ended or differential format. Retu ASIC outputs XearL and XearLC form the left channel audio output, and XearR and XearRC the right channel audio output. XearLC and XearRC are the ground pins if the output works in a single-ended operation.

Xear lines have 22 Ω series resistors in each line.

In the Pop-Port™ side, HSEAR P and HSEAR N form the left channel output, and HSEAR R P and HSEAR R N the right channel output. Respectively, HSEAR N and HSEAR R N are the ground pins if the output works in a single-ended operation.

Analogue switches (type TS5A3159) are in the Xear lines to attenuate the headset signal level in IHF mode, when headset is inserted. The attenuation is about 15 dB.

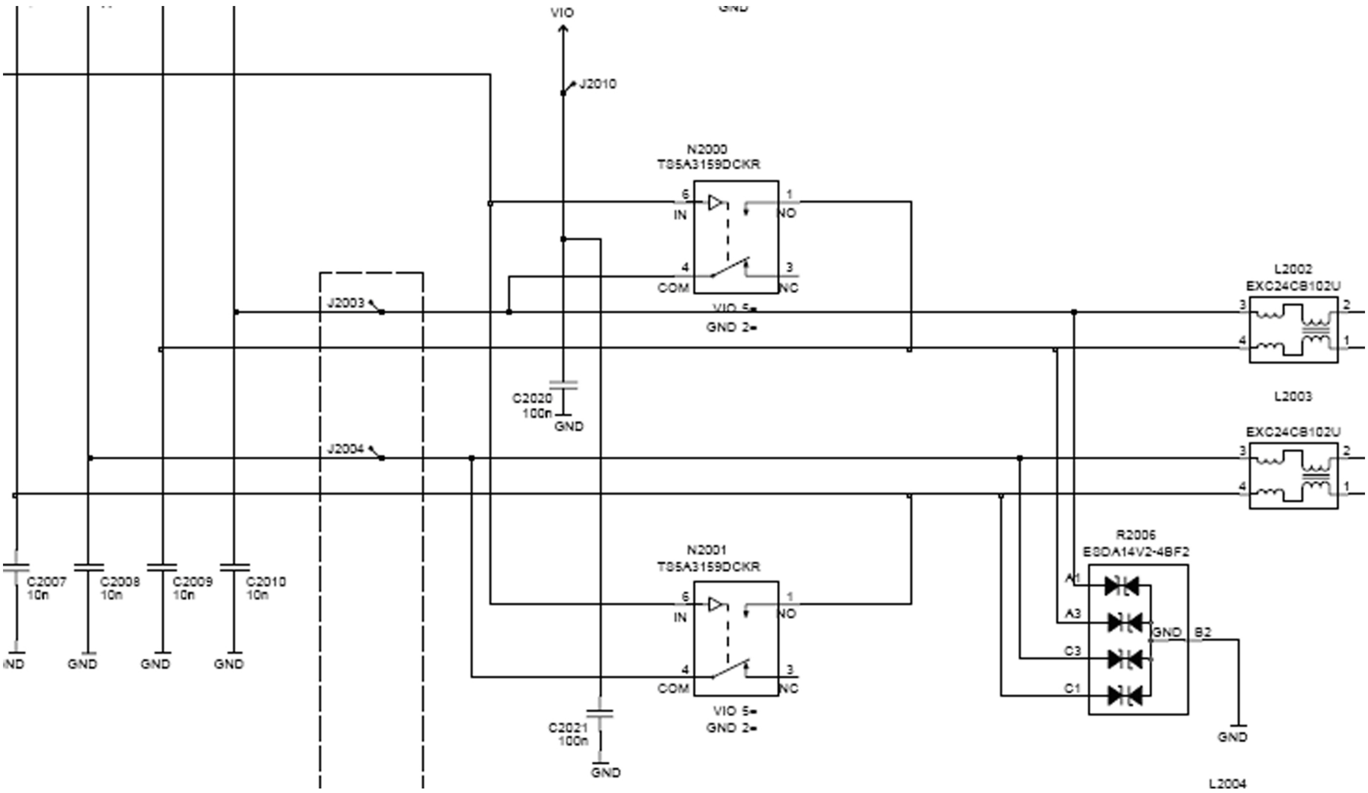

VIO
GND
J2010
N2000
TS5A3159DCKR
6
IN
1
NO
4
COM
3
NC
VIO 5
GND 2
J2003
J2004
C2020
100n
GND
L2002
EXC24CB102U
3
2
4
1
L2003
EXC24CB102U
N2001
TS5A3159DCKR
VIO 5
GND 2
C2021
100n
GND
R2006
ESDA14V2-4BF2
A1
A3
C3
C1
GND
B2
GND
L2004
C2007
10n
C2008
10n
C2009
10n
C2010
10n
GND
GND
GND
GND

Figure 90 External earpiece circuitry (Pop-Port connected on the right)

Vibra circuitry

Vibra is used for vibra-alarm function.

The vibra motor is connected to the Retu ASIC VibraP and VibraN Pulse Width Modulated (PWM) outputs.

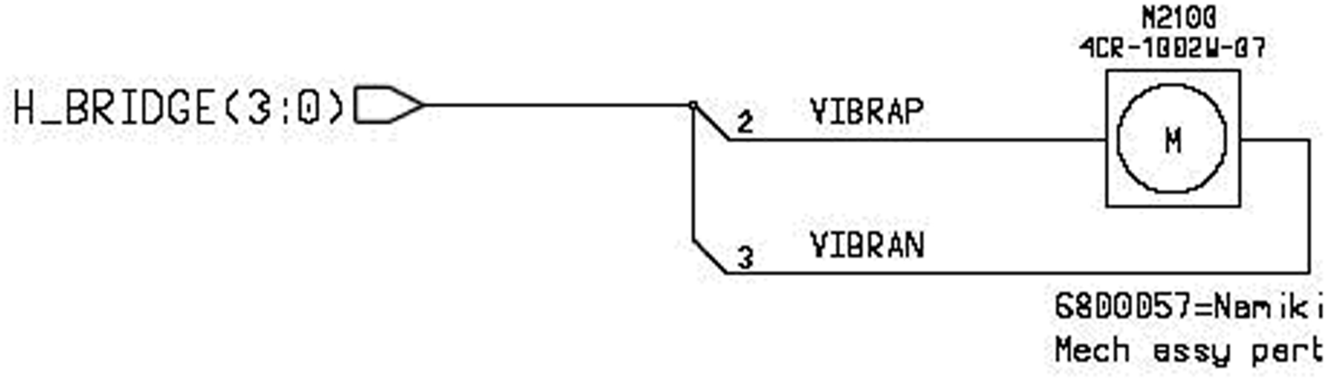

N2100
4CR-1002W-07
H_BRIDGE(3:0)
2
VIBRAP
M
3
VIBRAN
6800057=Namiki
Mech assy part

Figure 91 Vibra circuitry

Baseband technical specifications

RF-BB interfaces

Table 15 RF-BB Voltage supplies and references, interface connections and electrical characteristics

Signal	From	To	Parameter	Min	Typ	Max	Unit	Function
VBATRF	Battery	RF block	DC Voltage	3.05	3.6	5.4075	V	Battery supply voltage
								(NOTE 1)
						4.2		RF operating
GND	Battery	RF block	DC voltage		0		V	Ground
VCP1	RETU	RFIC	Voltage	4.6	4.75	4.9	V	Charge pump
	VRCP1	VCP	Current			6	mA	
			Noise density		TBD		nVrms/ÖHz	
VCP2	RETU	RFIC	Voltage	4.6	4.75	4.9	V	Charge pump
	VRCP2	VDAC	Current			6	mA	
			Noise density		TBD		nVrms/ÖHz	
VXO	RETU	VCTCXO	Voltage	2.42	2.5	Feb.58	V	Supply for reference oscillator, ref clk buffer and digital blocks of RFIC
		RFIC	Current			15	mA	
	VR1	VDIG	Noise density					
			100 Hz			400	nVrms/ÖHz	
			>300 Hz			100		
VREFRF01	RETU	RFIC	Voltage	1.325	1.35	1.375	V	Voltage reference for RFIC
	Vref	VBEXT	Current			100	µA	
			Noise voltage		30		µVrms	1 kHz 100 kHz
DAC_REF1	RFIC	RAPGSM	Current	24	32	40	µA	Temp/process dependent ref current for TXIQ DACs in RAPGSM
	DAC_REF1	Iref1	DC voltage			1	V	

Signal	From	To	Parameter	Min	Typ	Max	Unit	Function
VREFCM	RFIC	RAPGSM	Voltage	0.7	0.75	0.8	V	Reference voltages for RX ADCs in RAPGSM
	VREFCM	VrefP						

Note: The minimum voltage is the battery voltage, which has to be available for the RF circuitry all the time during operation. The voltage drop caused by losses (PCB tracks, filtering and internal resistance of the battery) has to be added to this figure. The maximum voltage is the absolute max figure.

Digital signals

Signal	From	To	Parameter	Min	Typ	Max	Unit	Function
TXRESETX	RAPGSM	RFIC	Logic high "1"	1.38		1.88	V	RFIC xreset
	TXReset	XRESET	Logic low "0"	0		0.4	V	
			Load resistance	10			KW	
			Load capacitance			20	pF	
			Timing accuracy			¼	symb	
RFBUSCLK	RAPGSM	RFIC	Logic high "1"	1.38		1.88	V	Serial bus for RFIC control
	RFBusClk	SCLK	Logic low "0"	0		0.4	V	
			Load resistance	10			KW	
			Load capacitance			20	pF	
			Frequency		19.2		MHz	
RFBUSDAT	RAPGSM	RFIC	See RFBusClk for parameters					
	RFBusDa	SDATA						
RFBUSENA	RAPGSM	RFIC	See RFBusClk for parameters					
	RFBusEn1X	XENA						

Table 16 Analog signals

Signal	From	To	Parameter	Min	Typ	Max	Unit	Function
AFC	RETU	VCTCXO	Voltage min	0		0.1	V	Automatic frequency control voltage for VCTCXO
	AFC	VC	max	2.3		2.35	V	
			Load resistance		22		KW	RC Low pass filter
			Load capacitance		10		nF	
			Resolution		11		bits	
RFCLKP	RFIC	RAPGSM	Frequency		38.4		MHz	Reference clock for base band
	REFP	RFclkP	Differential amplitude	0.5	0.8	1.6	Vpp	
			Duty cycle	-13		13	%	
			Load resistance	10			KW	
			Load capacitance			20	pF	
RFCLKN	REFN	RFclkN	See RFClkP					180° phase sift to RFClkP
RFCLKEXT	RFIC		Frequency		38.4		MHz	Reference clock for BT or GPS. In phase with RFClkP.
	REFG		Amplitude	0.25	0.4	0.8	Vpp	(NOTE 1)
			Duty cycle	-13		13	%	
			Load resistance	10			KW	
			Load capacitance			20	pF	

Signal	From	To	Parameter	Min	Typ	Max	Unit	Function
RFTEMP	RFIC	RETU	Voltage at +25°C	0.8		0.9	V	RF temperature sensor output (MUX output - used also for PA setup detection signal, GSM IQ-calibration signal)
	MUX_OUT	RFTemp	Temperature coefficient		-1.17		mV/°C	
			Temperature coefficient variation	-10		10	%	
TXC	RETU	RFIC	Voltage min	0		0.1	V	RFIC AGC control voltage
	TxC1	TXC	max	2.3		2.35		
								@200 kHz BW
			Temp variation	-12		12	mV	
			Noise density			500	uVrms	
			Load resistance		12		KW	(NOTE 2)
			Load capacitance		100		pF	
			Resolution		10		bits	
RXIP	RFIC	RAPGSM	Amplitude			1.5	Vpp	Differential analog RXI signal to baseband
RXIN	RX_OUT_PI	RXIP	Common mode voltage	0.7	0.75	0.8	V	
	RX_OUT_NI	RXIN	Load impedance	1			MW	
RXQP	RFIC	RAPGSM	See RXIP/RXIN for parameters					Differential analog RXQ signal to baseband
RXQN	RX_OUT_PQ	RXQP						
	RX_OUT_NQ	RXQN						

Signal	From	To	Parameter	Min	Typ	Max	Unit	Function
TXIP	RAPGSM	RFIC	Amplitude	0		127.5	uApp	Current mode TX baseband signals
TXIN		TXI_0	Common mode current		63.75		uA	
		TXI_180	Common mode voltage	0.625		0.7	V	
TXQP	RAPGSM	RFIC	See TXIP/TXIN for parameters					Current mode TX baseband signals
TXQN		TXQ_0						
		TXQ_180						

Note: External modules are required to include a DC-blocking capacitor in the signal line or the DC-blocking capacitor must be added outside the Rits 4.5 re-use engine area. It is recommended to use the external clock buffer between the re-use engine and the external modules.

Note: In RITSA 4 RF inside AHNE there’s a RC low pass circuit of12kΩ + 100pF in the TXC line.

External interfaces

Name of Connection	Connector reference
Charger	X2002
SIM	X2700
Mini SD	X3200
Battery connector	X2070
Pop-Port™	X2000

Pop-port™ connector

Pop-Port™ connector provides a fully differential 4–wire stereo line-level output connection and fully differential 2-wire mono line-level or microphone level input connection.

The handsfree driver in Retu is meant for the headset.

The output is driven in a fully differential mode. In the fully differential mode, the handsfree pin is the negative output and the HFCM pin is the positive output. The gain of the handsfree driver in the differential mode is 6 dB.

The earpiece and headset signals are multiplexed so that the outputs cannot be used simultaneously.

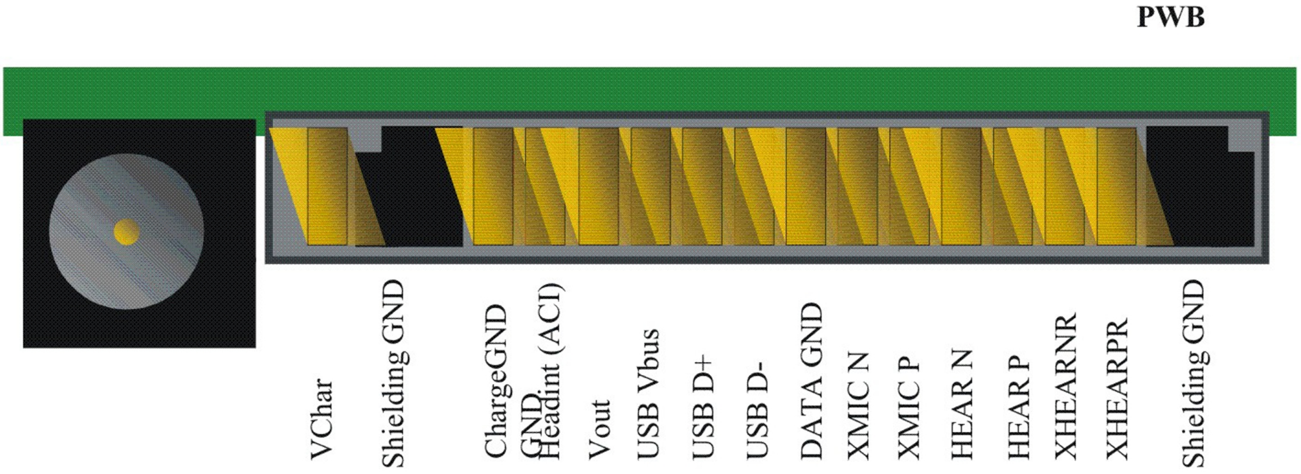

PWB
VChar
Shielding GND
ChargeGND
GND
Headint (ACI)
Vout
USB Vbus
USB D+
USB D-
DATA GND
XMIC N
XMIC P
HEAR N
HEAR P
XHEARNR
XHEARPR
Shielding GND

Figure 92 External audio connector

Table 17 Audio connector pin assignments

Pin #/ Signal name	Signal description	Spectral range	Voltage/ Current levels	Max or nominal serial impedance	Notes
1/ Charge	V Charge	DC	0-9V/ 0.85A		
2/ GND	Charge GND	-	0.85A	100mΩ (PWB+ conn.)	
3/ ACI	ACI	1kbits/s	Digital 0 / 2.5-2.78V	47Ω	Insertion & removal detection
4/ Vout	DC out	DC	2.78V 70 mA 2.5V 90mA	100mΩ (PWB+ conn.)	200mW
9 / XMIC N	Audio in	300-8k	1Vpp & 2.5-2.78VDC		
10 / XMIC P	Audio in	300-8k	1Vpp & 2.5-2.78VDC		
11 / HEAR N	Audio out	20-20k	1Vpp	22Ω	
12 / HEAR P	Audio out	20-20k	1Vpp	22Ω	
13 / HEAR R N	Audio out	20-20k	1Vpp	22Ω	Not conn. in mono
14 / HEAR R P	Audio out	20-20k	1Vpp	22Ω	Not conn. in mono

ACI interface electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
Accessory detection						

Description	Parameter	Min	Typ	Max	Unit	Notes
Headset detection threshold		1.75	1.9	2.05	V	Retu specific
Headset detection hysteresis			25		mV	
Headset detection pull ups		1	2	4	uA	
After Mbus is switched to HeadDet						
High-level input voltage (VDDS = 1.8V)	V_{IH}	0.7 x V_{DDS}		V_{DDS}	V	RAPGSM specific
Low-level input voltage	V_{IL}	0		0.3 x V_{DDS}	V	
High-level output voltage	V_{OH}	0.8 x V_{DDS}		V_{DDS}	V	
Low-level output voltage	V_{OL}	0		0.22 x VDDS	V	
Rise/fall time	tR/tF			25	ns	

VOUT electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Vout regulator for external accessories	VOUT	2.43	2.57	V	Max load 90mA

CBUS connections and electrical characteristics

CBUS connections

Pin name		I/O	Connection		Notes
RAPGSM	CbusDa	<->	Retu	Serdata	Cbus data
			Tahvo	CbusData	
RAPGSM	CbusClk	->	Retu	SerClk	Cbus clock, 2.4 MHz
			Tahvo	CbusClk	
RAPGSM	CbusEn1X	->	Retu	Sersel	Cbus enable

CBUS electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
High-level input voltage	VIH	0.7 x VDDS		VDDS	V	RAPGSM specific
(VDDS = 1.8V)						
Low-level input voltage	VIL	0		0.3 x VDDS	V	
High-level output voltage	VOH	0.8 x VDDS		VDDS	V	
Low-level output voltage	VOL	0		0.22 x VDDS	V	
Frequency, CbusClk	f	1	2.4	2.5	MHz	
Rise and fall time	tR/tF					Tahvo specific
CLK, DaOut, EnX				6	ns	
DaIn				25	ns	

USB/FBUS connections and electrical characteristics

The USB operates in the low-power bus-mode only. The USB host provides VBUS voltage (5V, 100mA at maximum) to USB device. The USB VBUS is connected to the input of the Tahvo USB/FBUS regulator, which output is 3.3V in USB mode.

After reset Tahvo USB/FBUS transceiver module and RAPGSM are in USB mode. Detection of the USB host cable is done in Tahvo. USB/FBUS regulator inside Tahvo gets 5V supply voltage to Vcc pin and regulates 3.3V when the USB host is connected.

Presence of the USB host is detected by monitoring the output of the Vcc regulator and its output can be read from Tahvo status register. This can also cause an interrupt to MCU and wake the system up from deep sleep mode

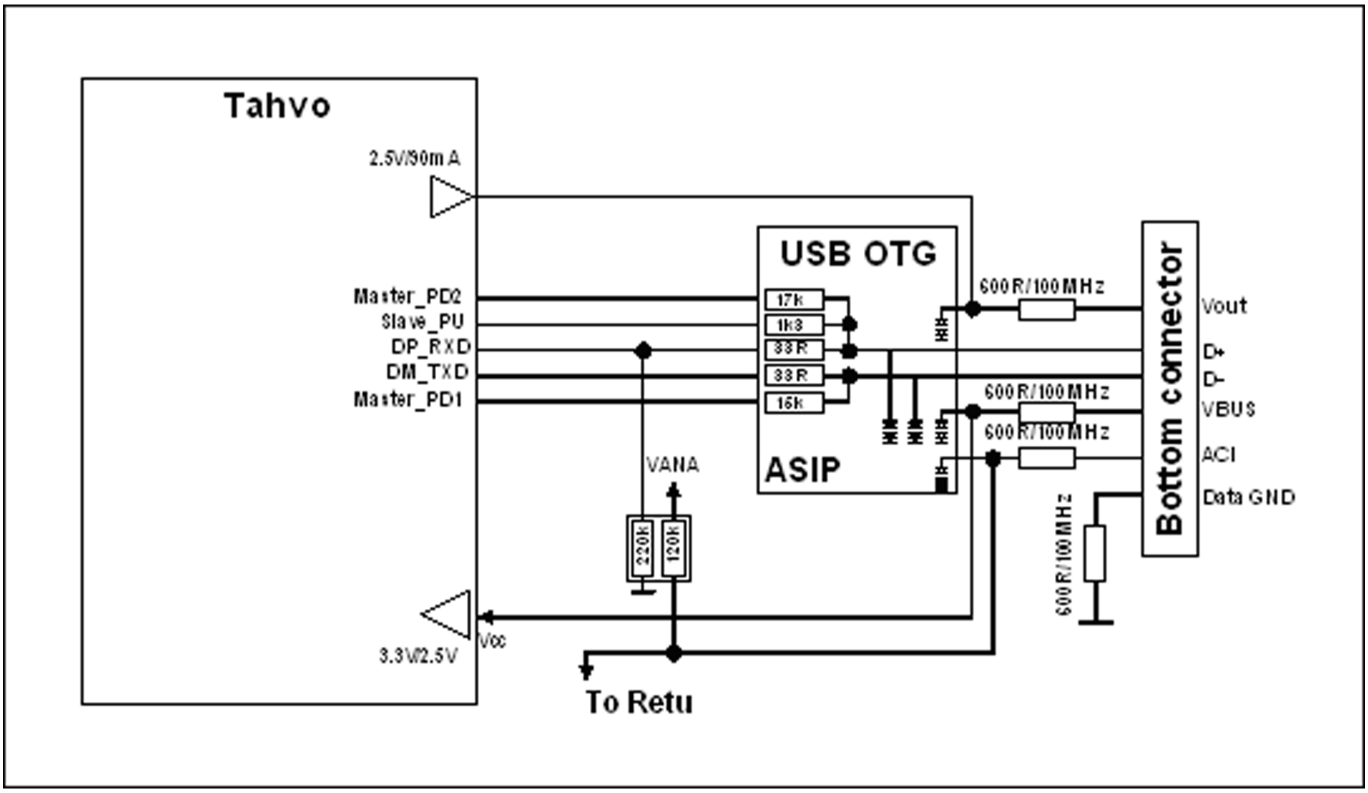

Tahvo
2.5V/90mA
Master_PD2
Slave_PU
DP_RXD
DM_TXD
Master_PD1
USB OTG
17k
1k3
33R
33R
16k
ASIP
VANA
220k
120k
3.3V/2.5V
Vcc
To Retu
600R/100MHz
600R/100MHz
600R/100MHz
600R/100MHz
Bottom connector
Vout
D+
D-
VBUS
ACI
Data GND

Table 18 USB/FBUS connections

Pin name		I/O	Connection		Notes
RAPGSM	USBVP_FRX	<-	Tahvo	VP_FRX	Single-ended D+ receiver data (D+) / received data (RXD) (USB / FBUS)
RAPGSM	USBVM_Clk	<-	Tahvo	VM_CLK	Single ended D- receiver data (D-) / clock for flash programming (CLK) (USB / FBUS)
RAPGSM	USBRCV_FRX2	<-	Tahvo	RCV_FRX2	Differential receiver data / received data_2 (RXD2) (USB / FBUS)
RAPGSM	USBFSE0_FTX	->	Tahvo	FTX	Transmitted data (FBUS). Selected by SEMODE=1

Table 19 USB/FBUS electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
High-level input voltage (VDDSHV2 = 1.8V)	VIH	0.7 x VDDSHV2		VDDSHV2	V	
Low-level Input voltage	VIL	0		0.3 x VDDSHV2	V	
High-level output voltage	VOH	0.8 x VDDSHV2		VDDSHV2	V	
Low-level output voltage	VOL	0		0.22 x VDDSHV2	V	

Description	Parameter	Min	Typ	Max	Unit	Notes
Rise/fall time	tR/tF	0		25	ns	

Headset hook detection interface (XMICN) electrical characteristics

Description	Min	Typ	Max	Unit	Notes
Hook detection threshold 1	1.25	1.35	1.45	V	Two fixed thresholds inside N2200. Selectable by SW
Hook detection threshold 2	0.5	0.6	0.7	V	
Hook detection hysteresis		25		mV	
Hook detection pull ups	1	2	4	uA	

Audio signal electrical characteristics

Description	Parameter	Typ	Unit	Notes
XMIC N	Audio in	1	V_{pp}	DC Offset 2.5-2.78V
XMIC P	Audio in	1	V_{pp}	DC Offset 2.5-2.78V
HSEAR N	Audio out	1	V_{pp}	22Ω nominal serial impedance
HSEAR P	Audio out	1	V_{pp}	22Ω nominal serial impedance
HSEAR R N	Audio out	1	V_{pp}	22Ω nominal serial impedance
				Not connected in mono
HSEAR R P	Audio out	1	V_{pp}	22Ω nominal serial impedance
				Not connected in mono

MiniSD IF electrical signal characteristics

Description	Parameter	Min	Max	Unit	Notes
MiniSD point of view					
High-level output voltage	VOH			V	IOH = ±10uA
(VMMC = 2.8V)		0.75xVMMC	VMMC+0.3		
Low-level output voltage	VOL		0.125xVMMC	V	IOL = ±10 uA
(VMMC = 2.8V)		-0.3			

Description	Parameter	Min	Max	Unit	Notes
High-level input voltage	VIH			V	IIH = ±10uA
(VMMC = 2.8V)		0.625*VMMC	VMMC+0.3		
Low-level Input voltage	VIL			V	IIL = ±10uA
(VMMC = 2.8V)		-0.3	0.25*VMMC		
RAPGSM point of view					
High-level output voltage (VIO = 1.85V)	VOH	VIO-0.45		V	
Low-level output voltage	VOL		0.45	V	
High-level input voltage	VIH	0.65x VIO		V	
Low-level Input voltage	VIL		0.35x VIO	V	

SIM connections and electrical characteristics

Table 20 SIM IF connections

Pin	Signal	I/O	Engine connection		Notes
C1	VSIM	Out	Retu	VSIM1	Supply voltage to SIM card, 1.8V or 3.0V.
C2	SIMRST	Out	Retu	SIM1Rst	Reset signal to SIM card
C3	SIMCLK	Out	Retu	SIM1ClkC	Clock signal to SIM card
C5	GND	-	GND		Ground
C7	SIMDATA	In/Out	Retu	SIM1DaC	Data input /output

Table 21 SIM electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
High-level input voltage (VDDS = 1.8V/3.0V)	VIH	0.7 x VDDS		VDDS	V	RAPGSM specific
Low-level input voltage	VIL	0		0.3 x VDDS	V	
High-level output voltage	VOH	0.8 x VDDS		VDDS	V	
Low-level output voltage	VOL	0		0.22 x VDDS	V	
Frequency, SIMClk1	f	1		5	MHz	

Description	Parameter	Min	Typ	Max	Unit	Notes
Rise & fall time SIMClk1 SIMIOCtrl1 SIMIODa1	tR/tF			10ns 10ns 10ns		

Camera interface connections

Table 22 Camera interface connections

Pin	Signal	I/O	Engine connection		Notes
1	GND1				Ground line corresponding to VDD
2	SDA	<->	GenIO30	SDA	I2C serial control bus data
3	CCP D+	->	SpecialIO0	D+	Differential serial data, positive node
4	SCL	<-	GenIO31	SCL	I2C serial control bus clock
5	CCP D-	->	SpecialIO1	D-	Differential serial data, negative node
6	CAMCLK	<-	GenIO68	ExtClk	System clock for camera module
7	VDDI	<-	Regulator	VCAM	Camera Digital Voltage 1.8V
8	GND3				Ground line corresponding to ExtClk

Charger connector and charging interface connections & electrical characteristics

Table 23 Charging interface connections

Pin	Signal	I/O	Engine connection		Notes
1	Vchar	In	Tahvo	VCharIn1, 2	Charging voltage / charger detection, Center pin
2	Charge GND		Ground		Charger ground

Table 24 Charging IF electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Vchar	V Charge	0	16	V	Center pin
Vchar	I Charge		0.95	A	Center pin
Charge GND			0.85	A	

Description	Parameter	Min	Max	Unit	Notes
Threshold for charging, rising (TAHVO)	V_{MSTR+}	2.1		V	Typical value
Threshold for charging, falling (TAHVO)	V_{MSTR-}	1.9		V	Typical value

Battery connector and interface connections & electrical characteristics

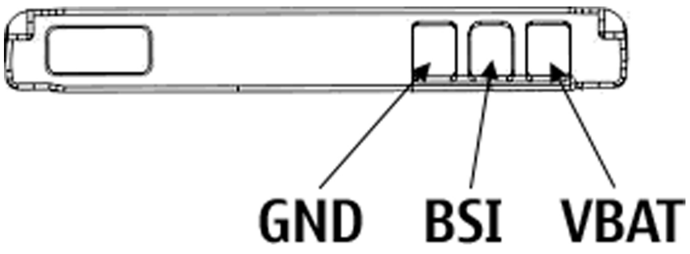


Figure 93 Battery connector

Table 25 Battery interface connections

Pin	Signal	I/O	Engine connection		Notes
1	VBAT	->	EM ASIC N2200	VBAT	Battery voltage
2	BSI	->	EM ASIC N2200	BSI	Battery size indication (fixed resistor inside the battery pack)
3	GND		GND		Ground

Table 26 Battery IF electrical characteristics

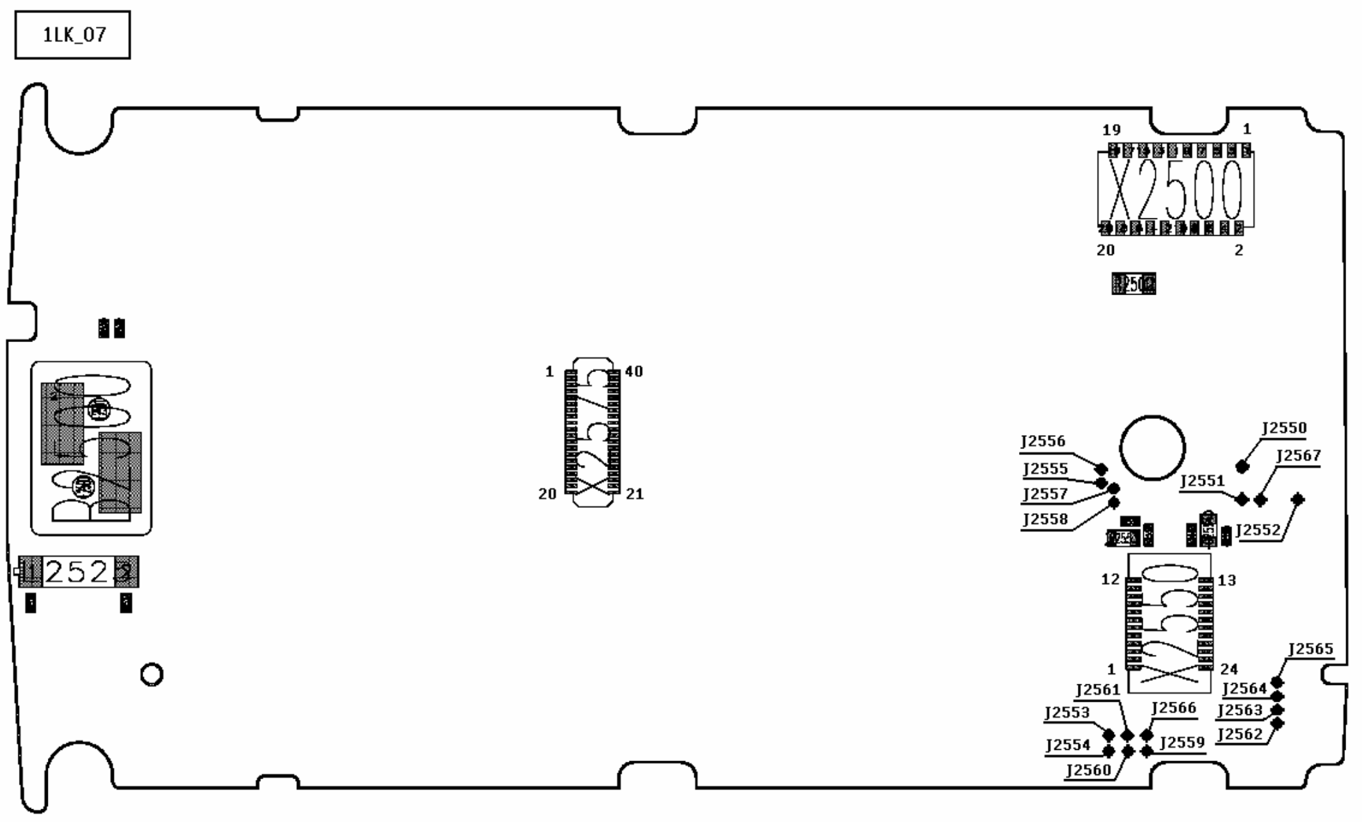
Description	Parameter	Max	Unit
Operation voltage	V_{IN}	4.23	VDC
Current rating	I_{IN}	0.9	A

Internal interfaces

Name of Connection	Connector reference	Notes
UI board connector	X2500	
Display	X2550	
Camera	X3300	Mirage 2MP
Vibra	M2100	
Microphone	B2100	
Earpiece	B2500	

Name of Connection	Connector reference	Notes
IHF speaker	B2101, B2102	
Upper flex connector	X2400	

Upper block connectors


1LK_07
19
1
X2500
20
2
1
40
X2575
20
21
J2556
J2555
J2557
J2558
J2550
J2567
J2551
J2552
12
13
X2550
1
24
J2565
J2561
J2564
J2553
J2566
J2563
J2554
J2559
J2562
J2560

Pin number, connector X2575	Destination	Test point	Name of the line/ signal	NOTES
1	GND	J2552	GND	
2	GND		GND	
3	X2550 pin14	J2567	QVGA_SET CURR	Display backlight feedback for LED driver
4	X2550 pin12, X2500 pin13	J2550	UB VLED	Backlight voltage
		J2551		VLED series=2*2 LEDS
5	GND		GND	
6	X2500, pin17		ROW0	RAPGSM GENIO for keyboard
7	X2500, pin6		ROW1	
8	X2500, pin7		ROW2	

Pin number, connector X2575	Destination	Test point	Name of the line/ signal	NOTES
9	GND			
10	GND			
11	X2500, pin8		COL2	RAPGSM GENIO for keyboard
12	X2500, pin9		COL1	
13	X2500, pin10		COL0	
14	GND		GND	
15	X2550, pin1	J2559	TE	LCD Tearing effect output
16	X2550, pin8	J2553	RDX	LCD Read signal
17	X2550, pin23	J2561	CSX	LCD Chip Select, low active
18	GND		GND	
19	X2550, pin24	J2560	RESX	LCD reset, low active
20	X2550, pin7	J2554	D/CX	Data/Command selection
21	X2550, pin17	J2566	WRX	LCD Write signal
22			GND	
23	X2550, pin22	J2562	D6	LCD Data
24	X2550, pin21	J2563	D4	LCD Data
25	X2550, pin20	J2564	D2	LCD Data
26	X2550, pin18	J2565	D0	LCD Data
27			GND	
28	X2550, pin6	J2555	D1	LCD Data
29	X2550, pin5	J2556	D3	LCD Data
30	X2550, pin3	J2557	D5	LCD Data
31	X2550, pin2	J2558	D7	LCD Data
32			GND	
33			NC	
34			NC	
35			GND	
36	EARPIECE		EARP	Analogue audio
37	EARPIECE		EARN	Analogue audio
38			GND	

Pin number, connector X2575	Destination	Test point	Name of the line/ signal	NOTES
39	X2550, pin15 (through filter)		VIO	Voltage for LCD
40	X2550, pin10 (through filter)		VAUX	Voltage for LCD

Keyboard interface electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
High-level input voltage (VIO = 1.8V)	VIH	0.65x VIO	VIO	0.3+ VIODDS	V	Row
Low-level input voltage	VIL	-0.3	0	0.35x VIO	V	Row
High-level output voltage	VOH	VIO- 0.45	VIO	VIO + 0.3	V	Column
Low-level output voltage	VOL	-0.3	0	0.35xVIO	V	Column

Back-up battery interface connections and electrical characteristics

Table 27 Back-up battery connections

Pin name	I/O	Connection	Notes
VBack	->	N2200, VBack	Back-up battery G2200 is connected to N2200 via coil

Table 28 Back-up battery electrical characteristics

Description	Parameter	Min	Typ	Max	Unit
Back-Up Battery Voltage	Vback	0	2.5	2.7	V

RF description

Introduction to receiver functionality

Receiver functions are implemented in RF ASIC N7505.

The receiver is a linear direct conversion receiver consisting of separate front ends (LNA (Low Noise Amplifier) and demodulator) for each supported system. After the demodulators, the signal paths are combined to one common BB path.

GSM receiver

As GSM850, GSM900, GSM1800, GSM1900 Rx branches are functionally identical, the following description is applicable to all of them.

The received signal goes from the GSM antenna to the front end module (FEM) which includes switches from band selection. FEM is followed by dedicated SAW filters which are dual packaged so that one holds SAWs for 850 and 900 and the other for 1800 and 1900 bands. The SAW filters are followed by integrated LNAs residing in N7505.

The LNAs are followed by demodulators which downconvert the signal to baseband I and Q signals.

The channel select filter is set to 115 kHz in the GSM mode.

During a DC1 operation, a sample of the DC level of the signal is stored in off chip capacitors. During reception, information is in turn used for subtracting the DC information from the input signal of the AGC (Automatic Gain Control) amplifier.

A DCN0 operation is carried out to discharge any charge from the capacitors before DCN1.

Introduction to transmitter functionality

Transmitter functions are implemented in the RF ASIC N7505. The ASIC contains a BB frequency low pass filter, which is tunable according to the signal bandwidth of the system in use.

In addition, the N7505 contains separate RF paths comprising a final frequency IQ modulator and VGA amplifiers.

GSM transmitter

N7505 receives an analogue IQ modulated signal from digital BB, which is first low pass filtered with filter corner frequency set to approximately 200 kHz. After the filter, the signal is routed to the GSM modulator. The amplifier gives 40 dB of power control dynamic range.

The appropriate routing after the modulator is selected by biasing either EGSM900 (/GSM850) or GSM1800/1900 variable gain amplifier. The amplifier gives 40 dB of power control dynamic range.

After the VGA stage the signal exits N7505. In case of GSM1800/1900 the signal goes directly to the FEM thru a balun, which converts single ended signal into balanced signal needed to feed the FEM. In case of GSM850 and EGSM900 the PA module is preceded by a SAW filter.

TX SAW Z7503 is also dual packaged so that the correct band is selected with control voltage coming from N7505. SAW also performs the unbalanced to balanced signal transformation. After the filter, the signal is fed to FEM. Finally the signal is routed to the antenna.

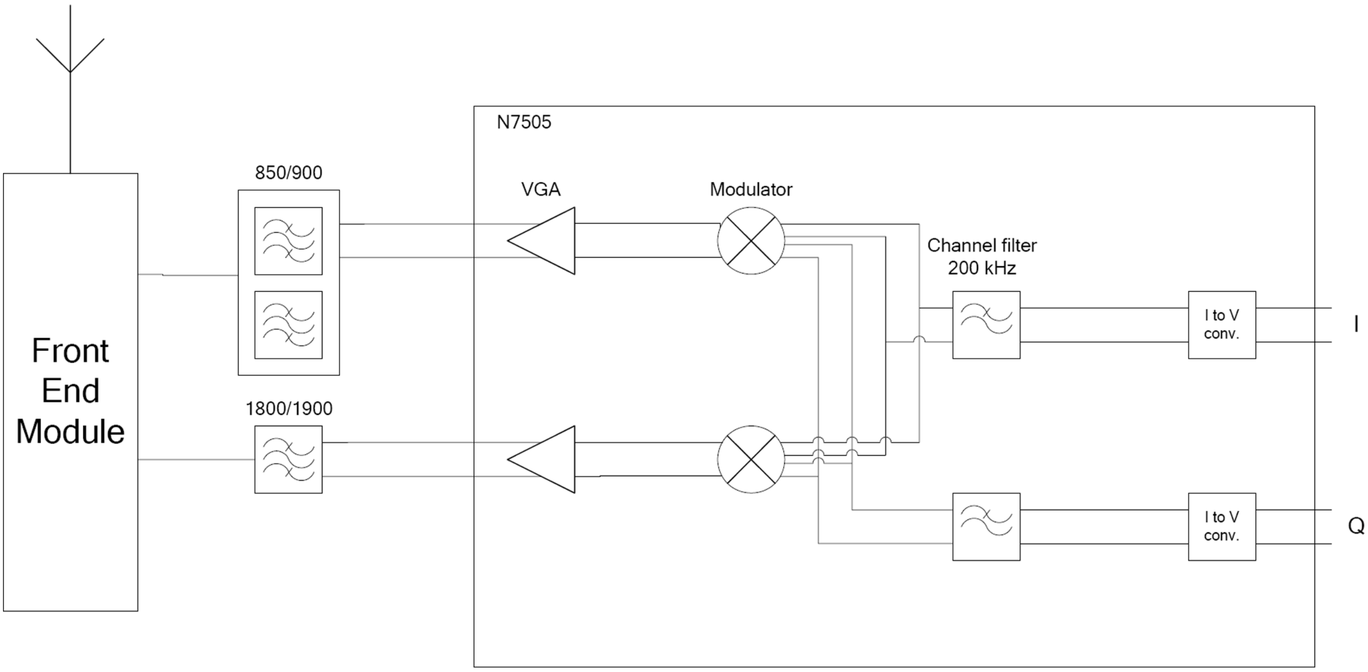


Figure 94 GSM transmitter

GSM power control

A closed control loop comprise an integrated power detector (in FEM) and an error amplifier. The error amplifier resides in N7505 and it controls the transmitter power of GSM.

Detector output from the FEM gives a DC level proportional to the output power. The DC voltage is fed to the negative input of the error amplifier where it is compared to the level of the reference signal, TXC. TXC is received from the BB circuitry.

The output of the error amplifier is fed to a buffer amplifier which in turn steers the VGA amplifier.

FEM is switched on and off by changing the bias currents. As a result the output power ramping and final power level of the transmitter are set in a controlled manner. During EDGE operation 8-PSK modulation is utilised.

The bias currents are also adjusted. The power control loop is opened during the data transmission in both GSMK and EDGE modes.

The loop is opened with a dedicated TXA-signal via RFBus. When the power is ramped up, a modulating bit sequence producing a constant envelope waveform is used and the power control loop is closed. Once the desired power level has been reached, the loop is opened and the power control voltage is kept constant.

When the active part of the burst is over the loop is again closed and the power is ramped down.

The power control loop is enabled and disabled in N7505 RF ASIC. In case of dual slot transmission the output power is ramped down between the consecutive slots.

GSM FEM (front end module)

A single GSM/EDGE FEM contains two separate amplifier chains, one for EGSM900 and GSM850 and another for GSM1800/1900.

Both amplifiers have a battery supply connection and two bias current inputs.

The bias current for final amplifier stage is adjusted according the power level in use. The bias currents are also used as on/off switching signals for PAs.

Frequency synthesizers

RF ASIC N7505 has a single synthesizer that is used to generate right frequencies for both TX and RX. The synthesizer consists of:

- PLL (Phase-Locked Loop)
- loop filter
- VCO (Voltage Controlled Oscillator)
- balun

The VCO frequencies are locked by PLLs into a reference oscillator, VCTCXO (Voltage Controlled Temperature Compensated Crystal Oscillator).

The PLLs is controlled via RFBus.

The VCOs operate at the channel frequency multiplied by two in the upper bands (for example, GSM1800/1900) and by four in EGSM900 and GSM850. The required frequency dividers required for modulators and demodulators are integrated in N7505.

Reference oscillators

A 38.4MHz VCTCXO is used as a reference oscillator for the frequency synthesizers.

Regulators

N7505 contains integrated regulators to supply regulated voltages for their internal circuitry and other RF parts.

Frequency mappings

GSM850 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
128	824.2	869.2	3296.8	3476.8	170	832.6	877.6	3330.4	3510.4	212	841.0	886.0	3364.0	3544.0
129	824.4	869.4	3297.6	3477.6	171	832.8	877.8	3331.2	3511.2	213	841.2	886.2	3364.8	3544.8
130	824.6	869.6	3298.4	3478.4	172	833.0	878.0	3332.0	3512.0	214	841.4	886.4	3365.6	3545.6
131	824.8	869.8	3299.2	3479.2	173	833.2	878.2	3332.8	3512.8	215	841.6	886.6	3366.4	3546.4
132	825.0	870.0	3300.0	3480.0	174	833.4	878.4	3333.6	3513.6	216	841.8	886.8	3367.2	3547.2
133	825.2	870.2	3300.8	3480.8	175	833.6	878.6	3334.4	3514.4	217	842.0	887.0	3368.0	3548.0
134	825.4	870.4	3301.6	3481.6	176	833.8	878.8	3335.2	3515.2	218	842.2	887.2	3368.8	3548.8
135	825.6	870.6	3302.4	3482.4	177	834.0	879.0	3336.0	3516.0	219	842.4	887.4	3369.6	3549.6
136	825.8	870.8	3303.2	3483.2	178	834.2	879.2	3336.8	3516.8	220	842.6	887.6	3370.4	3550.4
137	826.0	871.0	3304.0	3484.0	179	834.4	879.4	3337.6	3517.6	221	842.8	887.8	3371.2	3551.2
138	826.2	871.2	3304.8	3484.8	180	834.6	879.6	3338.4	3518.4	222	843.0	888.0	3372.0	3552.0
139	826.4	871.4	3305.6	3485.6	181	834.8	879.8	3339.2	3519.2	223	843.2	888.2	3372.8	3552.8
140	826.6	871.6	3306.4	3486.4	182	835.0	880.0	3340.0	3520.0	224	843.4	888.4	3373.6	3553.6
141	826.8	871.8	3307.2	3487.2	183	835.2	880.2	3340.8	3520.8	225	843.6	888.6	3374.4	3554.4
142	827.0	872.0	3308.0	3488.0	184	835.4	880.4	3341.6	3521.6	226	843.8	888.8	3375.2	3555.2
143	827.2	872.2	3308.8	3488.8	185	835.6	880.6	3342.4	3522.4	227	844.0	889.0	3376.0	3556.0
144	827.4	872.4	3309.6	3489.6	186	835.8	880.8	3343.2	3523.2	228	844.2	889.2	3376.8	3556.8
145	827.6	872.6	3310.4	3490.4	187	836.0	881.0	3344.0	3524.0	229	844.4	889.4	3377.6	3557.6
146	827.8	872.8	3311.2	3491.2	188	836.2	881.2	3344.8	3524.8	230	844.6	889.6	3378.4	3558.4
147	828.0	873.0	3312.0	3492.0	189	836.4	881.4	3345.6	3525.6	231	844.8	889.8	3379.2	3559.2
148	828.2	873.2	3312.8	3492.8	190	836.6	881.6	3346.4	3526.4	232	845.0	890.0	3380.0	3560.0
149	828.4	873.4	3313.6	3493.6	191	836.8	881.8	3347.2	3527.2	233	845.2	890.2	3380.8	3560.8
150	828.6	873.6	3314.4	3494.4	192	837.0	882.0	3348.0	3528.0	234	845.4	890.4	3381.6	3561.6
151	828.8	873.8	3315.2	3495.2	193	837.2	882.2	3348.8	3528.8	235	845.6	890.6	3382.4	3562.4
152	829.0	874.0	3316.0	3496.0	194	837.4	882.4	3349.6	3529.6	236	845.8	890.8	3383.2	3563.2
153	829.2	874.2	3316.8	3496.8	195	837.6	882.6	3350.4	3530.4	237	846.0	891.0	3384.0	3564.0
154	829.4	874.4	3317.6	3497.6	196	837.8	882.8	3351.2	3531.2	238	846.2	891.2	3384.8	3564.8
155	829.6	874.6	3318.4	3498.4	197	838.0	883.0	3352.0	3532.0	239	846.4	891.4	3385.6	3565.6
156	829.8	874.8	3319.2	3499.2	198	838.2	883.2	3352.8	3532.8	240	846.6	891.6	3386.4	3566.4
157	830.0	875.0	3320.0	3500.0	199	838.4	883.4	3353.6	3533.6	241	846.8	891.8	3387.2	3567.2
158	830.2	875.2	3320.8	3500.8	200	838.6	883.6	3354.4	3534.4	242	847.0	892.0	3388.0	3568.0
159	830.4	875.4	3321.6	3501.6	201	838.8	883.8	3355.2	3535.2	243	847.2	892.2	3388.8	3568.8
160	830.6	875.6	3322.4	3502.4	202	839.0	884.0	3356.0	3536.0	244	847.4	892.4	3389.6	3569.6
161	830.8	875.8	3323.2	3503.2	203	839.2	884.2	3356.8	3536.8	245	847.6	892.6	3390.4	3570.4
162	831.0	876.0	3324.0	3504.0	204	839.4	884.4	3357.6	3537.6	246	847.8	892.8	3391.2	3571.2
163	831.2	876.2	3324.8	3504.8	205	839.6	884.6	3358.4	3538.4	247	848.0	893.0	3392.0	3572.0
164	831.4	876.4	3325.6	3505.6	206	839.8	884.8	3359.2	3539.2	248	848.2	893.2	3392.8	3572.8
165	831.6	876.6	3326.4	3506.4	207	840.0	885.0	3360.0	3540.0	249	848.4	893.4	3393.6	3573.6
166	831.8	876.8	3327.2	3507.2	208	840.2	885.2	3360.8	3540.8	250	848.6	893.6	3394.4	3574.4
167	832.0	877.0	3328.0	3508.0	209	840.4	885.4	3361.6	3541.6	251	848.8	893.8	3395.2	3575.2

EGSM900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
975	880,2	925,2	3520,8	3700,8	1	890,2	935,2	3560,8	3740,8	63	902,6	947,6	3610,4	3790,4
976	880,4	925,4	3521,6	3701,6	2	890,4	935,4	3561,6	3741,6	64	902,8	947,8	3611,2	3791,2
977	880,6	925,6	3522,4	3702,4	3	890,6	935,6	3562,4	3742,4	65	903,0	948,0	3612,0	3792,0
978	880,8	925,8	3523,2	3703,2	4	890,8	935,8	3563,2	3743,2	66	903,2	948,2	3612,8	3792,8
979	881,0	926,0	3524,0	3704,0	5	891,0	936,0	3564,0	3744,0	67	903,4	948,4	3613,6	3793,6
980	881,2	926,2	3524,8	3704,8	6	891,2	936,2	3564,8	3744,8	68	903,6	948,6	3614,4	3794,4
981	881,4	926,4	3525,6	3705,6	7	891,4	936,4	3565,6	3745,6	69	903,8	948,8	3615,2	3795,2
982	881,6	926,6	3526,4	3706,4	8	891,6	936,6	3566,4	3746,4	70	904,0	949,0	3616,0	3796,0
983	881,8	926,8	3527,2	3707,2	9	891,8	936,8	3567,2	3747,2	71	904,2	949,2	3616,8	3796,8
984	882,0	927,0	3528,0	3708,0	10	892,0	937,0	3568,0	3748,0	72	904,4	949,4	3617,6	3797,6
985	882,2	927,2	3528,8	3708,8	11	892,2	937,2	3568,8	3748,8	73	904,6	949,6	3618,4	3798,4
986	882,4	927,4	3529,6	3709,6	12	892,4	937,4	3569,6	3749,6	74	904,8	949,8	3619,2	3799,2
987	882,6	927,6	3530,4	3710,4	13	892,6	937,6	3570,4	3750,4	75	905,0	950,0	3620,0	3800,0
988	882,8	927,8	3531,2	3711,2	14	892,8	937,8	3571,2	3751,2	76	905,2	950,2	3620,8	3800,8
989	883,0	928,0	3532,0	3712,0	15	893,0	938,0	3572,0	3752,0	77	905,4	950,4	3621,6	3801,6
990	883,2	928,2	3532,8	3712,8	16	893,2	938,2	3572,8	3752,8	78	905,6	950,6	3622,4	3802,4
991	883,4	928,4	3533,6	3713,6	17	893,4	938,4	3573,6	3753,6	79	905,8	950,8	3623,2	3803,2
992	883,6	928,6	3534,4	3714,4	18	893,6	938,6	3574,4	3754,4	80	906,0	951,0	3624,0	3804,0
993	883,8	928,8	3535,2	3715,2	19	893,8	938,8	3575,2	3755,2	81	906,2	951,2	3624,8	3804,8
994	884,0	929,0	3536,0	3716,0	20	894,0	939,0	3576,0	3756,0	82	906,4	951,4	3625,6	3805,6
995	884,2	929,2	3536,8	3716,8	21	894,2	939,2	3576,8	3756,8	83	906,6	951,6	3626,4	3806,4
996	884,4	929,4	3537,6	3717,6	22	894,4	939,4	3577,6	3757,6	84	906,8	951,8	3627,2	3807,2
997	884,6	929,6	3538,4	3718,4	23	894,6	939,6	3578,4	3758,4	85	907,0	952,0	3628,0	3808,0
998	884,8	929,8	3539,2	3719,2	24	894,8	939,8	3579,2	3759,2	86	907,2	952,2	3628,8	3808,8
999	885,0	930,0	3540,0	3720,0	25	895,0	940,0	3580,0	3760,0	87	907,4	952,4	3629,6	3809,6
1000	885,2	930,2	3540,8	3720,8	26	895,2	940,2	3580,8	3760,8	88	907,6	952,6	3630,4	3810,4
1001	885,4	930,4	3541,6	3721,6	27	895,4	940,4	3581,6	3761,6	89	907,8	952,8	3631,2	3811,2
1002	885,6	930,6	3542,4	3722,4	28	895,6	940,6	3582,4	3762,4	90	908,0	953,0	3632,0	3812,0
1003	885,8	930,8	3543,2	3723,2	29	895,8	940,8	3583,2	3763,2	91	908,2	953,2	3632,8	3812,8
1004	886,0	931,0	3544,0	3724,0	30	896,0	941,0	3584,0	3764,0	92	908,4	953,4	3633,6	3813,6
1005	886,2	931,2	3544,8	3724,8	31	896,2	941,2	3584,8	3764,8	93	908,6	953,6	3634,4	3814,4
1006	886,4	931,4	3545,6	3725,6	32	896,4	941,4	3585,6	3765,6	94	908,8	953,8	3635,2	3815,2
1007	886,6	931,6	3546,4	3726,4	33	896,6	941,6	3586,4	3766,4	95	909,0	954,0	3636,0	3816,0
1008	886,8	931,8	3547,2	3727,2	34	896,8	941,8	3587,2	3767,2	96	909,2	954,2	3636,8	3816,8
1009	887,0	932,0	3548,0	3728,0	35	897,0	942,0	3588,0	3768,0	97	909,4	954,4	3637,6	3817,6
1010	887,2	932,2	3548,8	3728,8	36	897,2	942,2	3588,8	3768,8	98	909,6	954,6	3638,4	3818,4
1011	887,4	932,4	3549,6	3729,6	37	897,4	942,4	3589,6	3769,6	99	909,8	954,8	3639,2	3819,2
1012	887,6	932,6	3550,4	3730,4	38	897,6	942,6	3590,4	3770,4	100	910,0	955,0	3640,0	3820,0
1013	887,8	932,8	3551,2	3731,2	39	897,8	942,8	3591,2	3771,2	101	910,2	955,2	3640,8	3820,8
1014	888,0	933,0	3552,0	3732,0	40	898,0	943,0	3592,0	3772,0	102	910,4	955,4	3641,6	3821,6
1015	888,2	933,2	3552,8	3732,8	41	898,2	943,2	3592,8	3772,8	103	910,6	955,6	3642,4	3822,4
1016	888,4	933,4	3553,6	3733,6	42	898,4	943,4	3593,6	3773,6	104	910,8	955,8	3643,2	3823,2
1017	888,6	933,6	3554,4	3734,4	43	898,6	943,6	3594,4	3774,4	105	911,0	956,0	3644,0	3824,0
1018	888,8	933,8	3555,2	3735,2	44	898,8	943,8	3595,2	3775,2	106	911,2	956,2	3644,8	3824,8
1019	889,0	934,0	3556,0	3736,0	45	899,0	944,0	3596,0	3776,0	107	911,4	956,4	3645,6	3825,6
1020	889,2	934,2	3556,8	3736,8	46	899,2	944,2	3596,8	3776,8	108	911,6	956,6	3646,4	3826,4
1021	889,4	934,4	3557,6	3737,6	47	899,4	944,4	3597,6	3777,6	109	911,8	956,8	3647,2	3827,2
1022	889,6	934,6	3558,4	3738,4	48	899,6	944,6	3598,4	3778,4	110	912,0	957,0	3648,0	3828,0
1023	889,8	934,8	3559,2	3739,2	49	899,8	944,8	3599,2	3779,2	111	912,2	957,2	3648,8	3828,8
0	890,0	935,0	3560,0	3740,0	50	900,0	945,0	3600,0	3780,0	112	912,4	957,4	3649,6	3829,6
					51	900,2	945,2	3600,8	3780,8	113	912,6	957,6	3650,4	3830,4
					52	900,4	945,4	3601,6	3781,6	114	912,8	957,8	3651,2	3831,2
					53	900,6	945,6	3602,4	3782,4	115	913,0	958,0	3652,0	3832,0
					54	900,8	945,8	3603,2	3783,2	116	913,2	958,2	3652,8	3832,8
					55	901,0	946,0	3604,0	3784,0	117	913,4	958,4	3653,6	3833,6
					56	901,2	946,2	3604,8	3784,8	118	913,6	958,6	3654,4	3834,4
					57	901,4	946,4	3605,6	3785,6	119	913,8	958,8	3655,2	3835,2
					58	901,6	946,6	3606,4	3786,4	120	914,0	959,0	3656,0	3836,0
					59	901,8	946,8	3607,2	3787,2	121	914,2	959,2	3656,8	3836,8
					60	902,0	947,0	3608,0	3788,0	122	914,4	959,4	3657,6	3837,6
					61	902,2	947,2	3608,8	3788,8	123	914,6	959,6	3658,4	3838,4
					62	902,4	947,4	3609,6	3789,6	124	914,8	959,8	3659,2	3839,2

GSM1800 frequencies

Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx
512	1710.2	1805.2	3420.4	3610.4	606	1729.0	1824.0	3458.0	3648.0	700	1747.8	1842.8	3495.6	3685.6	793	1766.4	1861.4	3532.8	3722.8
513	1710.4	1805.4	3420.8	3610.8	607	1729.2	1824.2	3458.4	3648.4	701	1748.0	1843.0	3496.0	3686.0	794	1766.6	1861.6	3533.2	3723.2
514	1710.6	1805.6	3421.2	3611.2	608	1729.4	1824.4	3458.8	3648.8	702	1748.2	1843.2	3496.4	3686.4	795	1766.8	1861.8	3533.6	3723.6
515	1710.8	1805.8	3421.6	3611.6	609	1729.6	1824.6	3459.2	3649.2	703	1748.4	1843.4	3496.8	3686.8	796	1767.0	1862.0	3534.0	3724.0
516	1711.0	1806.0	3422.0	3612.0	610	1729.8	1824.8	3459.6	3649.6	704	1748.6	1843.6	3497.2	3687.2	797	1767.2	1862.2	3534.4	3724.4
517	1711.2	1806.2	3422.4	3612.4	611	1730.0	1825.0	3460.0	3650.0	705	1748.8	1843.8	3497.6	3687.6	798	1767.4	1862.4	3534.8	3724.8
518	1711.4	1806.4	3422.8	3612.8	612	1730.2	1825.2	3460.4	3650.4	706	1749.0	1844.0	3498.0	3688.0	799	1767.6	1862.6	3535.2	3725.2
519	1711.6	1806.6	3423.2	3613.2	613	1730.4	1825.4	3460.8	3650.8	707	1749.2	1844.2	3498.4	3688.4	800	1767.8	1862.8	3535.6	3725.6
520	1711.8	1806.8	3423.6	3613.6	614	1730.6	1825.6	3461.2	3651.2	708	1749.4	1844.4	3498.8	3688.8	801	1768.0	1863.0	3536.0	3726.0
521	1712.0	1807.0	3424.0	3614.0	615	1730.8	1825.8	3461.6	3651.6	709	1749.6	1844.6	3499.2	3689.2	802	1768.2	1863.2	3536.4	3726.4
522	1712.2	1807.2	3424.4	3614.4	616	1731.0	1826.0	3462.0	3652.0	710	1749.8	1844.8	3499.6	3689.6	803	1768.4	1863.4	3536.8	3726.8
523	1712.4	1807.4	3424.8	3614.8	617	1731.2	1826.2	3462.4	3652.4	711	1750.0	1845.0	3500.0	3690.0	804	1768.6	1863.6	3537.2	3727.2
524	1712.6	1807.6	3425.2	3615.2	618	1731.4	1826.4	3462.8	3652.8	712	1750.2	1845.2	3500.4	3690.4	805	1768.8	1863.8	3537.6	3727.6
525	1712.8	1807.8	3425.6	3615.6	619	1731.6	1826.6	3463.2	3653.2	713	1750.4	1845.4	3500.8	3690.8	806	1769.0	1864.0	3538.0	3728.0
526	1713.0	1808.0	3426.0	3616.0	620	1731.8	1826.8	3463.6	3653.6	714	1750.6	1845.6	3501.2	3691.2	807	1769.2	1864.2	3538.4	3728.4
527	1713.2	1808.2	3426.4	3616.4	621	1732.0	1827.0	3464.0	3654.0	715	1750.8	1845.8	3501.6	3691.6	808	1769.4	1864.4	3538.8	3728.8
528	1713.4	1808.4	3426.8	3616.8	622	1732.2	1827.2	3464.4	3654.4	716	1751.0	1846.0	3502.0	3692.0	809	1769.6	1864.6	3539.2	3729.2
529	1713.6	1808.6	3427.2	3617.2	623	1732.4	1827.4	3464.8	3654.8	717	1751.2	1846.2	3502.4	3692.4	810	1769.8	1864.8	3539.6	3729.6
530	1713.8	1808.8	3427.6	3617.6	624	1732.6	1827.6	3465.2	3655.2	718	1751.4	1846.4	3502.8	3692.8	811	1770.0	1865.0	3540.0	3730.0
531	1714.0	1809.0	3428.0	3618.0	625	1732.8	1827.8	3465.6	3655.6	719	1751.6	1846.6	3503.2	3693.2	812	1770.2	1865.2	3540.4	3730.4
532	1714.2	1809.2	3428.4	3618.4	626	1733.0	1828.0	3466.0	3656.0	720	1751.8	1846.8	3503.6	3693.6	813	1770.4	1865.4	3540.8	3730.8
533	1714.4	1809.4	3428.8	3618.8	627	1733.2	1828.2	3466.4	3656.4	721	1752.0	1847.0	3504.0	3694.0	814	1770.6	1865.6	3541.2	3731.2
534	1714.6	1809.6	3429.2	3619.2	628	1733.4	1828.4	3466.8	3656.8	722	1752.2	1847.2	3504.4	3694.4	815	1770.8	1865.8	3541.6	3731.6
535	1714.8	1809.8	3429.6	3619.6	629	1733.6	1828.6	3467.2	3657.2	723	1752.4	1847.4	3504.8	3694.8	816	1771.0	1866.0	3542.0	3732.0
536	1715.0	1810.0	3430.0	3620.0	630	1733.8	1828.8	3467.6	3657.6	724	1752.6	1847.6	3505.2	3695.2	817	1771.2	1866.2	3542.4	3732.4
537	1715.2	1810.2	3430.4	3620.4	631	1734.0	1829.0	3468.0	3658.0	725	1752.8	1847.8	3505.6	3695.6	818	1771.4	1866.4	3542.8	3732.8
538	1715.4	1810.4	3430.8	3620.8	632	1734.2	1829.2	3468.4	3658.4	726	1753.0	1848.0	3506.0	3696.0	819	1771.6	1866.6	3543.2	3733.2
539	1715.6	1810.6	3431.2	3621.2	633	1734.4	1829.4	3468.8	3658.8	727	1753.2	1848.2	3506.4	3696.4	820	1771.8	1866.8	3543.6	3733.6
540	1715.8	1810.8	3431.6	3621.6	634	1734.6	1829.6	3469.2	3659.2	728	1753.4	1848.4	3506.8	3696.8	821	1772.0	1867.0	3544.0	3734.0
541	1716.0	1811.0	3432.0	3622.0	635	1734.8	1829.8	3469.6	3659.6	729	1753.6	1848.6	3507.2	3697.2	822	1772.2	1867.2	3544.4	3734.4
542	1716.2	1811.2	3432.4	3622.4	636	1735.0	1830.0	3470.0	3660.0	730	1753.8	1848.8	3507.6	3697.6	823	1772.4	1867.4	3544.8	3734.8
543	1716.4	1811.4	3432.8	3622.8	637	1735.2	1830.2	3470.4	3660.4	731	1754.0	1849.0	3508.0	3698.0	824	1772.6	1867.6	3545.2	3735.2
544	1716.6	1811.6	3433.2	3623.2	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	825	1772.8	1867.8	3545.6	3735.6
545	1716.8	1811.8	3433.6	3623.6	639	1735.6	1830.6	3471.2	3661.2	733	1754.4	1849.4	3508.8	3698.8	826	1773.0	1868.0	3546.0	3736.0
546	1717.0	1812.0	3434.0	3624.0	640	1735.8	1830.8	3471.6	3661.6	734	1754.6	1849.6	3509.2	3699.2	827	1773.2	1868.2	3546.4	3736.4
547	1717.2	1812.2	3434.4	3624.4	641	1736.0	1831.0	3472.0	3662.0	735	1754.8	1849.8	3509.6	3699.6	828	1773.4	1868.4	3546.8	3736.8
548	1717.4	1812.4	3434.8	3624.8	642	1736.2	1831.2	3472.4	3662.4	736	1755.0	1850.0	3510.0	3700.0	829	1773.6	1868.6	3547.2	3737.2
549	1717.6	1812.6	3435.2	3625.2	643	1736.4	1831.4	3472.8	3662.8	737	1755.2	1850.2	3510.4	3700.4	830	1773.8	1868.8	3547.6	3737.6
550	1717.8	1812.8	3435.6	3625.6	644	1736.6	1831.6	3473.2	3663.2	738	1755.4	1850.4	3510.8	3700.8	831	1774.0	1869.0	3548.0	3738.0
551	1718.0	1813.0	3436.0	3626.0	645	1736.8	1831.8	3473.6	3663.6	739	1755.6	1850.6	3511.2	3701.2	832	1774.2	1869.2	3548.4	3738.4
552	1718.2	1813.2	3436.4	3626.4	646	1737.0	1832.0	3474.0	3664.0	740	1755.8	1850.8	3511.6	3701.6	833	1774.4	1869.4	3548.8	3738.8
553	1718.4	1813.4	3436.8	3626.8	647	1737.2	1832.2	3474.4	3664.4	741	1756.0	1851.0	3512.0	3702.0	834	1774.6	1869.6	3549.2	3739.2
554	1718.6	1813.6	3437.2	3627.2	648	1737.4	1832.4	3474.8	3664.8	742	1756.2	1851.2	3512.4	3702.4	835	1774.8	1869.8	3549.6	3739.6
555	1718.8	1813.8	3437.6	3627.6	649	1737.6	1832.6	3475.2	3665.2	743	1756.4	1851.4	3512.8	3702.8	836	1775.0	1870.0	3550.0	3740.0
556	1719.0	1814.0	3438.0	3628.0	650	1737.8	1832.8	3475.6	3665.6	744	1756.6	1851.6	3513.2	3703.2	837	1775.2	1870.2	3550.4	3740.4
557	1719.2	1814.2	3438.4	3628.4	651	1738.0	1833.0	3476.0	3666.0	745	1756.8	1851.8	3513.6	3703.6	838	1775.4	1870.4	3550.8	3740.8
558	1719.4	1814.4	3438.8	3628.8	652	1738.2	1833.2	3476.4	3666.4	746	1757.0	1852.0	3514.0	3704.0	839	1775.6	1870.6	3551.2	3741.2
559	1719.6	1814.6	3439.2	3629.2	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	840	1775.8	1870.8	3551.6	3741.6
560	1719.8	1814.8	3439.6	3629.6	654	1738.6	1833.6	3477.2	3667.2	748	1757.4	1852.4	3514.8	3704.8	841	1776.0	1871.0	3552.0	3742.0
561	1720.0	1815.0	3440.0	3630.0	655	1738.8	1833.8	3477.6	3667.6	749	1757.6	1852.6	3515.2	3705.2	842	1776.2	1871.2	3552.4	3742.4
562	1720.2	1815.2	3440.4	3630.4	656	1739.0	1834.0	3478.0	3668.0	750	1757.8	1852.8	3515.6	3705.6	843	1776.4	1871.4	3552.8	3742.8
563	1720.4	1815.4	3440.8	3630.8	657	1739.2	1834.2	3478.4	3668.4	751	1758.0	1853.0	3516.0	3706.0	844	1776.6	1871.6	3553.2	3743.2
564	1720.6	1815.6	3441.2	3631.2	658	1739.4	1834.4	3478.8	3668.8	752	1758.2	1853.2	3516.4	3706.4	845	1776.8	1871.8	3553.6	3743.6
565	1720.8	1815.8	3441.6	3631.6	659	1739.6	1834.6	3479.2	3669.2	753	1758.4	1853.4	3516.8	3706.8	846	1777.0	1872.0	3554.0	3744.0
566	1721.0	1816.0	3442.0	3632.0	660	1739.8	1834.8	3479.6	3669.6	754	1758.6	1853.6	3517.2	3707.2	847	1777.2	1872.2	3554.4	3744.4
567	1721.2	1816.2	3442.4	3632.4	661	1740.0	1835.0	3480.0	3670.0	755	1758.8	1853.8	3517.6	3707.6	848	1777.4	1872.4	3554.8	3744.8
568	1721.4	1816.4	3442.8	3632.8	662	1740.2	1835.2	3480.4	3670.4	756	1759.0	1854.0	3518.0	3708.0	849	1777.6	1872.6	3555.2	3745.2
569	1721.6	1816.6	3443.2	3633.2	663	1740.4	1835.4	3480.8	3670.8	757	1759.2	1854.2	3518.4	3708.4	850	1777.8	1872.8	3555.6	3745.6
570	1721.8	1816.8	3443.6	3633.6	664	1740.6	1835.6	3481.2	3671.2	758	1759.4	1854.4	3518.8	3708.8	851	1778.0	1873.0	3556.0	3746.0
571	1722.0	1817.0	3444.0	3634.0	665	1740.8	1835.8	3481.6	3671.6	759	1759.6	1854.6	3519.2	3709.2	852	1778.2	1873.2	3556.4	3746.4
572	1722.2	1817.2	3444.4	3634.4	666	1741.0	1836.0	3482.0	3672.0	760	1759.8	1854.8	3519.6	3709.6	853	1778.4	1873.4	3556.8	3746.8
573	1722.4	1817.4	3444.8	3634.8	667	1741.2	1836.2	3482.4	3672.4	761	1760.0	1855.0	3520.0	3710.0	854	1778.6	1873.6	3557.2	3747.2
574	1722.6	1817.6	3445.2	3635.2	668	1741.4	1836.4	3482.8	3672.8	762	1760.2	1855.2	3520.4	3710.4	855	1778.8	1873.8	3557.6	3747.6
575	1722.8	1817.8	3445.6	3635.6	669	1741.6	1836.6	3483.2	3673.2	763	1760.4	1855.4	3520.8	3710.8	856	1779.0	1874.0	3558.0	3748.0
576	1723.0	1818.0	3446.0	3636.0	670	1741.8	1836.8	3483.6	3673.6	764	1760.6	1855.6	3521.2	3711.2	857	1779.2	1874.2	3558.4	3748.4
577	1723.2	1818.2	3446.4	3636.4	671	1742.0	1837.0	3484.0	3674.0	765	1760.8	1855.8	3521.6	3711.6	858	1779.4	1874.4	3558.8	3748.8
578	1723.4	1818.4	3446.8	3636.8	672	1742.2	1837.2	3484.4	3674.4	766	1761.0	1856.0	3522.0	3712.0	859	1779.6	1874.6	3559.2	3749.2
579	1723.6	1818.6	3447.2	3637.2	673	1742.4	1837.4	3484.8	3674.8	767	1761.2	1856.2	3522.4	3712.4	860	1779.8	1874.8	3559.6	3749.6
580	1723.8	1818.8	3447.6	3637.6	674	1742.6	1837.6	3485.2	3675.2	768	1761.4	1856.4	3522.8	3712.8	861	1780.0	1875.0	3560.0	3750.0
581	1724.0	1819.0	3448.0	3638.0	675	1742.8	1837.8	3485.6	3675.6	769	1761.6	1856.6	3523.2	3713.2	862	1780.2	1875.2	3560.4	3750.4
582	1724.2	1819.2	3448.4	3638.4	676	1743.0	1838.0	3486.0	3676.0	770	1761.8	1856.8	3523.6	3713.6	863	1780.4	1875.4	3560.8	3750.8
583	1724.4	1819.4	3448.8	3638.8	677	1743.2	1838.2	3486.4	3676.4	771	1762.0	1857.0	3524.0	3714.0	864	1780.6	1875.6	3561.2	3751.2
584	1724.6	1819.6	3449.2	3639.2	678	1743.4	1838.4	3486.8	3676.8	772	1762.2	1857.2	3524.4	3714.4	865	1780.8	1875.8	3561.6	3751.6
585	1724.8	1819.8	3449.6	3639.6	679	1743.6	1838.6	3487.2	3677.2	773	1762.4	1857.4	3524.8	3714.8	866	1781.0	1876.0	3562.0	3752.0
586	1725.0	1820.0	3450.0	3640.0	680	1743.8	1838.8	3487.6	3677.6	774	1762.6	1857.6	3525.2	3715.2	867	1781.2	1876.2	3562.4	3752.4
587	1725.2	1820.2	3450.4	3640.4	681	1744.0	1839.0	3488.0	3678.0	775	1762.8	1857.8	3525.6	3715.6	868	1781.4	1876.4	3562.8	3752.8
588	1725.4	1820.4	3450.8	3640.8	682	1744.2	1839.2	3488.4	3678.4	776	1763.0	1858.0	3526.0	3716.0	869	1781.6	1876.6	3563.2	3753.2
589	1725.6	1820.6	3451.2	3641.2	683	1744.4	1839.4	3488.8	3678.8	777	1763.2	1858.2	3526.4	3716.4	870	1781.8	1876.8	3563.6	3753.6
590	1725.8	1820.8	3451.6	3641.6	684	1744.6	1839.6	3489.2	3679.2	778	1763.4	1858.4	3526.8	3716.8	871	1782.0	1877.0	3564.0	3754.0
591	1726.0	1821.0	3452.0	3642.0	685	1744.8	1839.8	3489.6	3679.6	779	1763.6	1858.6	3527.2	3717.2	872	1782.2	1877.2	3564.4	3754.4
592	1726.2	1821.2	3452.4	3642.4	686	1745.0	1840.0	3490.0	3680.0	780	1763.8	1858.8	3527.6	3717.6	873	1782.4	1877.4	3564.8	3754.8
593	1726.4	1821.4	3452.8	3642.8	687	1745.2	1840.2	3490.4	3680.4	781	1764.0	1859.0	3528.0	3718.0	874	1782.6	1877.6	3565.2	3755.2
594	1726.6	1821.6	3453.2	3643.2	688	1745.4	1840.4	3490.8	3680.8	782	1764.2	1859.2	3528.4	3718.4	875	1782.8	1877.8	3565.6	3755.6
595	1726.8	1821.8	3453.6	3643.6	689	1745.6	1840.6	3491.2	3681.2	783	1764.4	1859.4	3528.8	3718.8	876	1783.0	1878.0	3566.0	3756.0
596	1727.0	1822.0	3454.0	3644.0	690	1745.8	1840.8	3491.6	3681.6	784	1764.6	1859.6	3529.2	3719.2	877	1783.2	1878.2	3566.4	3756.4
597	1727.2	1822.2	3454.4	3644.4	691	1746.0	1841.0	3492.0	3682.0	785	1764.8	1859.8	3529.6	3719.6	878	1783.4	1878.4	3566.8	3756.8
598	1727.4	1822.4	3454.8	3644.8	692	1746.2	1841.2	3492.4	3682.4	786	1765.0	1860.0	3530.0	3720.0	879	1783.6	1878.6	3567.2	3757.2
599	1727.6	1822.6	3455.2	3645.2	693	1746.4	1841.4	3492.8	3682.8	787	1765.2	1860.2	3530.4	3720.4	880	1783.8	1878.8	3567.6	3757.6
600	1727.8	1822.8	3455.6	3645.6	694	1746.6	1841.6	3493.2	3683.2	788	1765.4	1860.4	3530.8	3720.8	881	1784.0	1879.0	3568.0	3758.0
601	1728.0	1823.0	3456.0	3646.0	695	1746.8	1841.8	3493.6	3683.6	789	1765.6	1860.6	3531.2	3721.2	882	1784.2	1879.2	3568.4	3758.4
602	1728.2	1823.2	3456.4	3646.4	696	1747.0	1842.0	3494.0	3684.0	790	1765.8	1860.8	3531.6	3721.6	883	1784.4	1879.4	3568.8	3758.8
603	1728.4	1823.4	3456.8	3646.8	697	1747.2	1842.2	3494.4	3684.4	791	1766.0	1861.0	3532.0	3722.0	884	1784.6	1879.6	3569.2	3759.2
604	1728.6	1823.6	3457.2	3647.2	698	1747.4	1842.4	3494.8	3684.8	792	1766.2	1861.2	3532.4	3722.4	885	1784.8	1879.8	3569.6	3759.6
605	1728.8	1823.8	3457.6	3647.6	699	1747.6	1842.6	3495.2	3685.2										

GSM1900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
512	1850,2	1930,2	3700,4	3860,4	606	1869,0	1949,0	3738,0	3898,0	700	1887,8	1967,8	3775,6	3935,6	794	1906,6	1986,6	3813,2	3973,2
513	1850,4	1930,4	3700,8	3860,8	607	1869,2	1949,2	3738,4	3898,4	701	1888,0	1968,0	3776,0	3936,0	795	1906,8	1986,8	3813,6	3973,6
514	1850,6	1930,6	3701,2	3861,2	608	1869,4	1949,4	3738,8	3898,8	702	1888,2	1968,2	3776,4	3936,4	796	1907,0	1987,0	3814,0	3974,0
515	1850,8	1930,8	3701,6	3861,6	609	1869,6	1949,6	3739,2	3899,2	703	1888,4	1968,4	3776,8	3936,8	797	1907,2	1987,2	3814,4	3974,4
516	1851,0	1931,0	3702,0	3862,0	610	1869,8	1949,8	3739,6	3899,6	704	1888,6	1968,6	3777,2	3937,2	798	1907,4	1987,4	3814,8	3974,8
517	1851,2	1931,2	3702,4	3862,4	611	1870,0	1950,0	3740,0	3900,0	705	1888,8	1968,8	3777,6	3937,6	799	1907,6	1987,6	3815,2	3975,2
518	1851,4	1931,4	3702,8	3862,8	612	1870,2	1950,2	3740,4	3900,4	706	1889,0	1969,0	3778,0	3938,0	800	1907,8	1987,8	3815,6	3975,6
519	1851,6	1931,6	3703,2	3863,2	613	1870,4	1950,4	3740,8	3900,8	707	1889,2	1969,2	3778,4	3938,4	801	1908,0	1988,0	3816,0	3976,0
520	1851,8	1931,8	3703,6	3863,6	614	1870,6	1950,6	3741,2	3901,2	708	1889,4	1969,4	3778,8	3938,8	802	1908,2	1988,2	3816,4	3976,4
521	1852,0	1932,0	3704,0	3864,0	615	1870,8	1950,8	3741,6	3901,6	709	1889,6	1969,6	3779,2	3939,2	803	1908,4	1988,4	3816,8	3976,8
522	1852,2	1932,2	3704,4	3864,4	616	1871,0	1951,0	3742,0	3902,0	710	1889,8	1969,8	3779,6	3939,6	804	1908,6	1988,6	3817,2	3977,2
523	1852,4	1932,4	3704,8	3864,8	617	1871,2	1951,2	3742,4	3902,4	711	1890,0	1970,0	3780,0	3940,0	805	1908,8	1988,8	3817,6	3977,6
524	1852,6	1932,6	3705,2	3865,2	618	1871,4	1951,4	3742,8	3902,8	712	1890,2	1970,2	3780,4	3940,4	806	1909,0	1989,0	3818,0	3978,0
525	1852,8	1932,8	3705,6	3865,6	619	1871,6	1951,6	3743,2	3903,2	713	1890,4	1970,4	3780,8	3940,8	807	1909,2	1989,2	3818,4	3978,4
526	1853,0	1933,0	3706,0	3866,0	620	1871,8	1951,8	3743,6	3903,6	714	1890,6	1970,6	3781,2	3941,2	808	1909,4	1989,4	3818,8	3978,8
527	1853,2	1933,2	3706,4	3866,4	621	1872,0	1952,0	3744,0	3904,0	715	1890,8	1970,8	3781,6	3941,6	809	1909,6	1989,6	3819,2	3979,2
528	1853,4	1933,4	3706,8	3866,8	622	1872,2	1952,2	3744,4	3904,4	716	1891,0	1971,0	3782,0	3942,0	810	1909,8	1989,8	3819,6	3979,6
529	1853,6	1933,6	3707,2	3867,2	623	1872,4	1952,4	3744,8	3904,8	717	1891,2	1971,2	3782,4	3942,4					
530	1853,8	1933,8	3707,6	3867,6	624	1872,6	1952,6	3745,2	3905,2	718	1891,4	1971,4	3782,8	3942,8					
531	1854,0	1934,0	3708,0	3868,0	625	1872,8	1952,8	3745,6	3905,6	719	1891,6	1971,6	3783,2	3943,2					
532	1854,2	1934,2	3708,4	3868,4	626	1873,0	1953,0	3746,0	3906,0	720	1891,8	1971,8	3783,6	3943,6					
533	1854,4	1934,4	3708,8	3868,8	627	1873,2	1953,2	3746,4	3906,4	721	1892,0	1972,0	3784,0	3944,0					
534	1854,6	1934,6	3709,2	3869,2	628	1873,4	1953,4	3746,8	3906,8	722	1892,2	1972,2	3784,4	3944,4					
535	1854,8	1934,8	3709,6	3869,6	629	1873,6	1953,6	3747,2	3907,2	723	1892,4	1972,4	3784,8	3944,8					
536	1855,0	1935,0	3710,0	3870,0	630	1873,8	1953,8	3747,6	3907,6	724	1892,6	1972,6	3785,2	3945,2					
537	1855,2	1935,2	3710,4	3870,4	631	1874,0	1954,0	3748,0	3908,0	725	1892,8	1972,8	3785,6	3945,6					
538	1855,4	1935,4	3710,8	3870,8	632	1874,2	1954,2	3748,4	3908,4	726	1893,0	1973,0	3786,0	3946,0					
539	1855,6	1935,6	3711,2	3871,2	633	1874,4	1954,4	3748,8	3908,8	727	1893,2	1973,2	3786,4	3946,4					
540	1855,8	1935,8	3711,6	3871,6	634	1874,6	1954,6	3749,2	3909,2	728	1893,4	1973,4	3786,8	3946,8					
541	1856,0	1936,0	3712,0	3872,0	635	1874,8	1954,8	3749,6	3909,6	729	1893,6	1973,6	3787,2	3947,2					
542	1856,2	1936,2	3712,4	3872,4	636	1875,0	1955,0	3750,0	3910,0	730	1893,8	1973,8	3787,6	3947,6					
543	1856,4	1936,4	3712,8	3872,8	637	1875,2	1955,2	3750,4	3910,4	731	1894,0	1974,0	3788,0	3948,0					
544	1856,6	1936,6	3713,2	3873,2	638	1875,4	1955,4	3750,8	3910,8	732	1894,2	1974,2	3788,4	3948,4					
545	1856,8	1936,8	3713,6	3873,6	639	1875,6	1955,6	3751,2	3911,2	733	1894,4	1974,4	3788,8	3948,8					
546	1857,0	1937,0	3714,0	3874,0	640	1875,8	1955,8	3751,6	3911,6	734	1894,6	1974,6	3789,2	3949,2					
547	1857,2	1937,2	3714,4	3874,4	641	1876,0	1956,0	3752,0	3912,0	735	1894,8	1974,8	3789,6	3949,6					
548	1857,4	1937,4	3714,8	3874,8	642	1876,2	1956,2	3752,4	3912,4	736	1895,0	1975,0	3790,0	3950,0					
549	1857,6	1937,6	3715,2	3875,2	643	1876,4	1956,4	3752,8	3912,8	737	1895,2	1975,2	3790,4	3950,4					
550	1857,8	1937,8	3715,6	3875,6	644	1876,6	1956,6	3753,2	3913,2	738	1895,4	1975,4	3790,8	3950,8					
551	1858,0	1938,0	3716,0	3876,0	645	1876,8	1956,8	3753,6	3913,6	739	1895,6	1975,6	3791,2	3951,2					
552	1858,2	1938,2	3716,4	3876,4	646	1877,0	1957,0	3754,0	3914,0	740	1895,8	1975,8	3791,6	3951,6					
553	1858,4	1938,4	3716,8	3876,8	647	1877,2	1957,2	3754,4	3914,4	741	1896,0	1976,0	3792,0	3952,0					
554	1858,6	1938,6	3717,2	3877,2	648	1877,4	1957,4	3754,8	3914,8	742	1896,2	1976,2	3792,4	3952,4					
555	1858,8	1938,8	3717,6	3877,6	649	1877,6	1957,6	3755,2	3915,2	743	1896,4	1976,4	3792,8	3952,8					
556	1859,0	1939,0	3718,0	3878,0	650	1877,8	1957,8	3755,6	3915,6	744	1896,6	1976,6	3793,2	3953,2					
557	1859,2	1939,2	3718,4	3878,4	651	1878,0	1958,0	3756,0	3916,0	745	1896,8	1976,8	3793,6	3953,6					
558	1859,4	1939,4	3718,8	3878,8	652	1878,2	1958,2	3756,4	3916,4	746	1897,0	1977,0	3794,0	3954,0					
559	1859,6	1939,6	3719,2	3879,2	653	1878,4	1958,4	3756,8	3916,8	747	1897,2	1977,2	3794,4	3954,4					
560	1859,8	1939,8	3719,6	3879,6	654	1878,6	1958,6	3757,2	3917,2	748	1897,4	1977,4	3794,8	3954,8					
561	1860,0	1940,0	3720,0	3880,0	655	1878,8	1958,8	3757,6	3917,6	749	1897,6	1977,6	3795,2	3955,2					
562	1860,2	1940,2	3720,4	3880,4	656	1879,0	1959,0	3758,0	3918,0	750	1897,8	1977,8	3795,6	3955,6					
563	1860,4	1940,4	3720,8	3880,8	657	1879,2	1959,2	3758,4	3918,4	751	1898,0	1978,0	3796,0	3956,0					
564	1860,6	1940,6	3721,2	3881,2	658	1879,4	1959,4	3758,8	3918,8	752	1898,2	1978,2	3796,4	3956,4					
565	1860,8	1940,8	3721,6	3881,6	659	1879,6	1959,6	3759,2	3919,2	753	1898,4	1978,4	3796,8	3956,8					
566	1861,0	1941,0	3722,0	3882,0	660	1879,8	1959,8	3759,6	3919,6	754	1898,6	1978,6	3797,2	3957,2					
567	1861,2	1941,2	3722,4	3882,4	661	1880,0	1960,0	3760,0	3920,0	755	1898,8	1978,8	3797,6	3957,6					
568	1861,4	1941,4	3722,8	3882,8	662	1880,2	1960,2	3760,4	3920,4	756	1899,0	1979,0	3798,0	3958,0					
569	1861,6	1941,6	3723,2	3883,2	663	1880,4	1960,4	3760,8	3920,8	757	1899,2	1979,2	3798,4	3958,4					
570	1861,8	1941,8	3723,6	3883,6	664	1880,6	1960,6	3761,2	3921,2	758	1899,4	1979,4	3798,8	3958,8					
571	1862,0	1942,0	3724,0	3884,0	665	1880,8	1960,8	3761,6	3921,6	759	1899,6	1979,6	3799,2	3959,2					
572	1862,2	1942,2	3724,4	3884,4	666	1881,0	1961,0	3762,0	3922,0	760	1899,8	1979,8	3799,6	3959,6					
573	1862,4	1942,4	3724,8	3884,8	667	1881,2	1961,2	3762,4	3922,4	761	1900,0	1980,0	3800,0	3960,0					
574	1862,6	1942,6	3725,2	3885,2	668	1881,4	1961,4	3762,8	3922,8	762	1900,2	1980,2	3800,4	3960,4					
575	1862,8	1942,8	3725,6	3885,6	669	1881,6	1961,6	3763,2	3923,2	763	1900,4	1980,4	3800,8	3960,8					
576	1863,0	1943,0	3726,0	3886,0	670	1881,8	1961,8	3763,6	3923,6	764	1900,6	1980,6	3801,2	3961,2					
577	1863,2	1943,2	3726,4	3886,4	671	1882,0	1962,0	3764,0	3924,0	765	1900,8	1980,8	3801,6	3961,6					
578	1863,4	1943,4	3726,8	3886,8	672	1882,2	1962,2	3764,4	3924,4	766	1901,0	1981,0	3802,0	3962,0					
579	1863,6	1943,6	3727,2	3887,2	673	1882,4	1962,4	3764,8	3924,8	767	1901,2	1981,2	3802,4	3962,4					
580	1863,8	1943,8	3727,6	3887,6	674	1882,6	1962,6	3765,2	3925,2	768	1901,4	1981,4	3802,8	3962,8					
581	1864,0	1944,0	3728,0	3888,0	675	1882,8	1962,8	3765,6	3925,6	769	1901,6	1981,6	3803,2	3963,2					
582	1864,2	1944,2	3728,4	3888,4	676	1883,0	1963,0	3766,0	3926,0	770	1901,8	1981,8	3803,6	3963,6					
583	1864,4	1944,4	3728,8	3888,8	677	1883,2	1963,2	3766,4	3926,4	771	1902,0	1982,0	3804,0	3964,0					
584	1864,6	1944,6	3729,2	3889,2	678	1883,4	1963,4	3766,8	3926,8	772	1902,2	1982,2	3804,4	3964,4					
585	1864,8	1944,8	3729,6	3889,6	679	1883,6	1963,6	3767,2	3927,2	773	1902,4	1982,4	3804,8	3964,8					
586	1865,0	1945,0	3730,0	3890,0	680	1883,8	1963,8	3767,6	3927,6	774	1902,6	1982,6	3805,2	3965,2					
587	1865,2	1945,2	3730,4	3890,4	681	1884,0	1964,0	3768,0	3928,0	775	1902,8	1982,8	3805,6	3965,6					
588	1865,4	1945,4	3730,8	3890,8	682	1884,2	1964,2	3768,4	3928,4	776	1903,0	1983,0	3806,0	3966,0					
589	1865,6	1945,6	3731,2	3891,2	683	1884,4	1964,4	3768,8	3928,8	777	1903,2	1983,2	3806,4	3966,4					
590	1865,8	1945,8	3731,6	3891,6	684	1884,6	1964,6	3769,2	3929,2	778	1903,4	1983,4	3806,8	3966,8					
591	1866,0	1946,0	3732,0	3892,0	685	1884,8	1964,8	3769,6	3929,6	779	1903,6	1983,6	3807,2	3967,2					
592	1866,2	1946,2	3732,4	3892,4	686	1885,0	1965,0	3770,0	3930,0	780	1903,8	1983,8	3807,6	3967,6					
593	1866,4	1946,4	3732,8	3892,8	687	1885,2	1965,2	3770,4	3930,4	781	1904,0	1984,0	3808,0	3968,0					
594	1866,6	1946,6	3733,2	3893,2	688	1885,4	1965,4	3770,8	3930,8	782	1904,2	1984,2	3808,4	3968,4					
595	1866,8	1946,8	3733,6	3893,6	689	1885,6	1965,6	3771,2	3931,2	783	1904,4	1984,4	3808,8	3968,8					
596	1867,0	1947,0	3734,0	3894,0	690	1885,8	1965,8	3771,6	3931,6	784	1904,6	1984,6	3809,2	3969,2					
597	1867,2	1947,2	3734,4	3894,4	691	1886,0	1966,0	3772,0	3932,0	785	1904,8	1984,8	3809,6	3969,6					
598	1867,4	1947,4	3734,8	3894,8	692	1886,2	1966,2	3772,4	3932,4	786	1905,0	1985,0	3810,0	3970,0					
599	1867,6	1947,6	3735,2	3895,2	693	1886,4	1966,4	3772,8	3932,8	787	1905,2	1985,2	3810,4	3970,4					
600	1867,8	1947,8	3735,6	3895,6	694	1886,6	1966,6	3773,2	3933,2	788	1905,4	1985,4	3810,8	3970,8					
601	1868,0	1948,0	3736,0	3896,0	695	1886,8	1966,8	3773,6	3933,6	789	1905,6	1985,6	3811,2	3971,2					
602	1868,2	1948,2	3736,4	3896,4	696	1887,0	1967,0	3774,0	3934,0	790	1905,8	1985,8	3811,6	3971,6					
603	1868,4	1948,4	3736,8	3896,8	697	1887,2	1967,2	3774,4	3934,4	791	1906,0	1986,0	3812,0	3972,0					
604	1868,6	1948,6	3737,2	3897,2	698	1887,4	1967,4	3774,8	3934,8	792	1906,2	1986,2	3812,4	3972,4					
605	1868,8	1948,8	3737,6	3897,6	699	1887,6	1967,6	3775,2	3935,2	793	1906,4	1986,4	3812,8	3972,8					

10 — Schematics

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BT, FM Radio....................10–9
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Signal overview....................10–11
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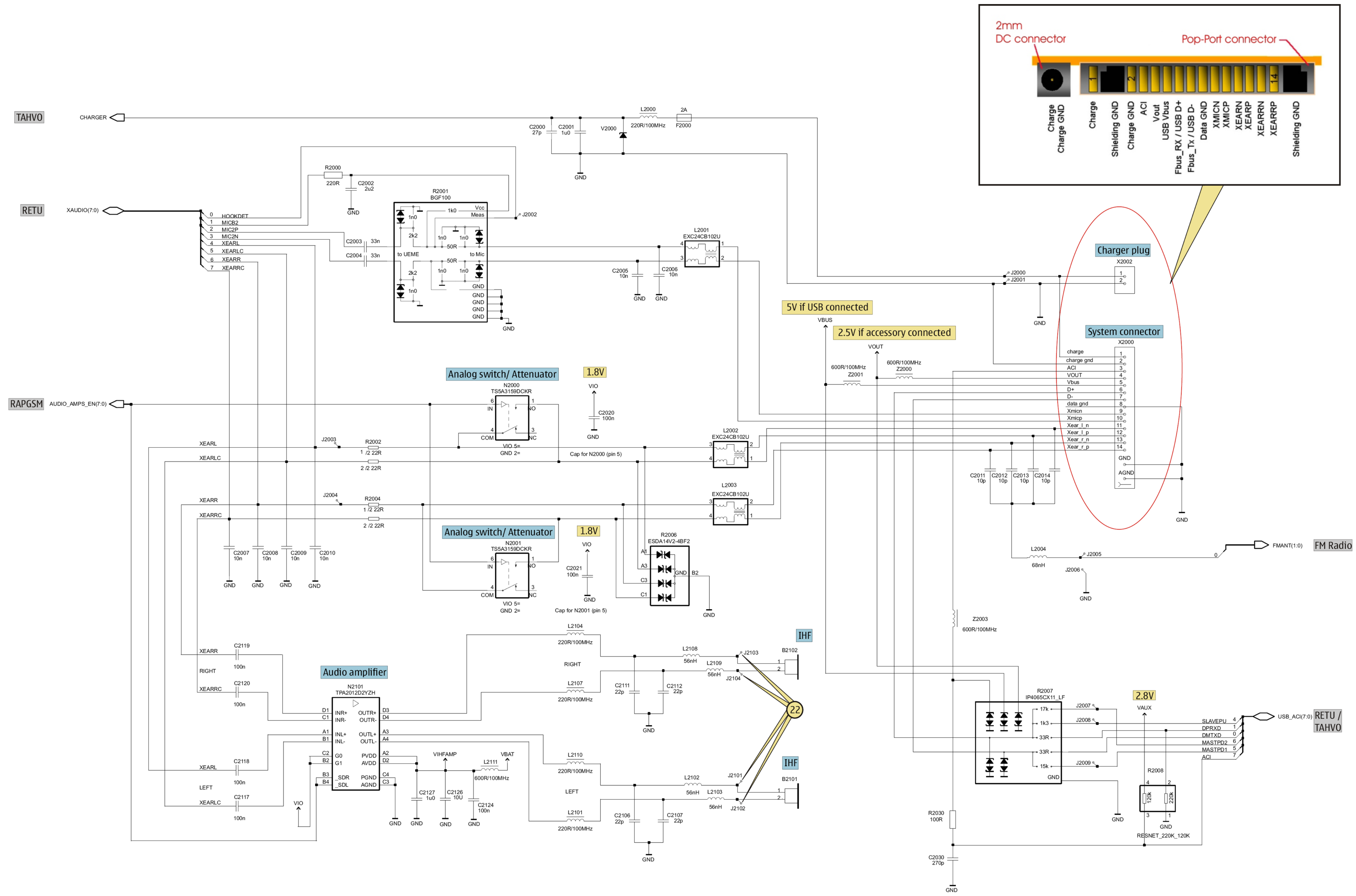
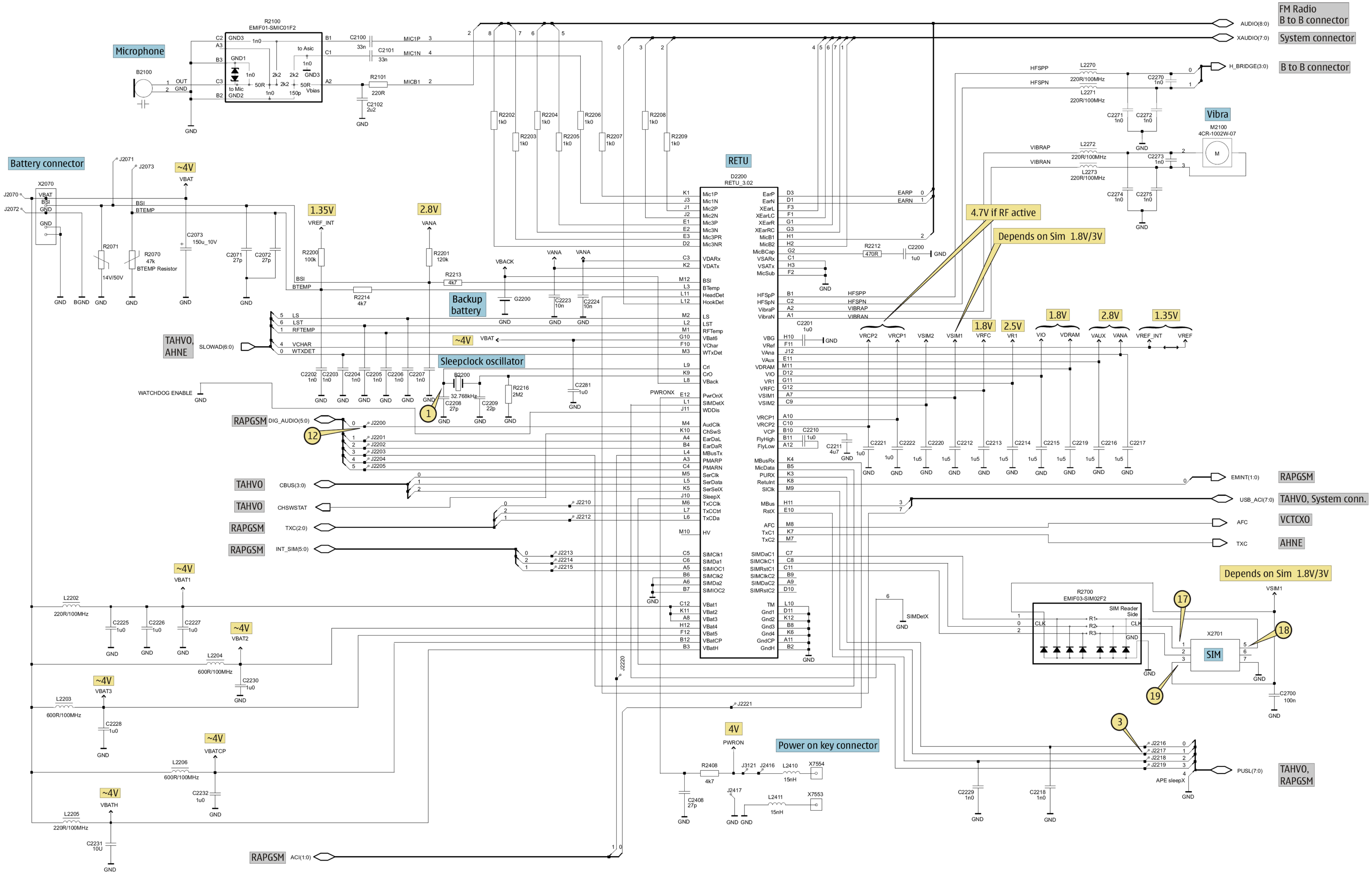
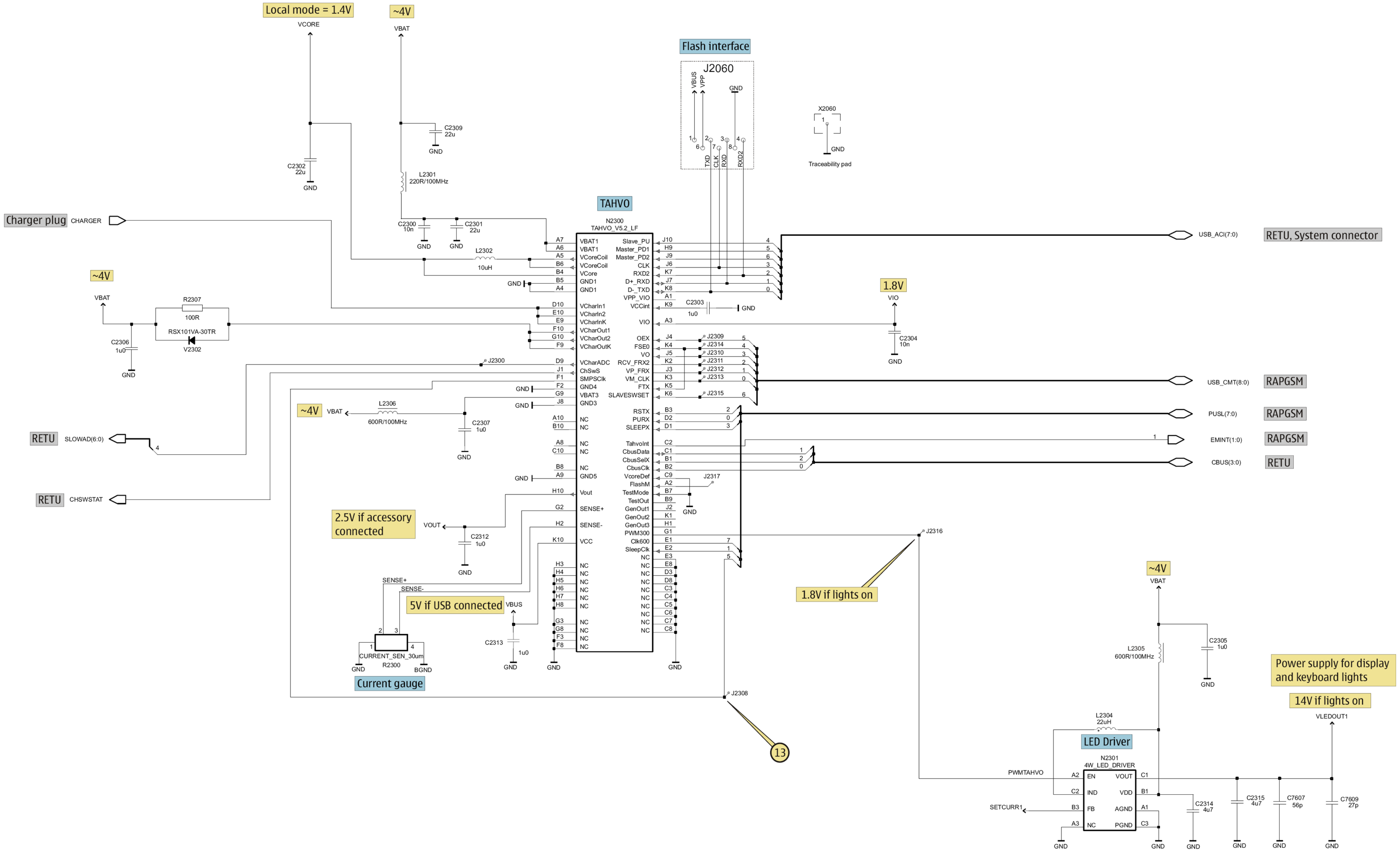
Audio


2mm
DC connector
Pop-Port connector
1
2
14
Charge
Charge GND
Charge
Shielding GND
Charge GND
ACI
Vout
USB Vbus
Fbus_RX / USB D+
Fbus_Tx / USB D-
Data GND
XMICN
XMICP
XEARN
XEARP
XEARRN
XEARRP
Shielding GND
TAHVO
CHARGER
RETU
XAUDIO(7:0)
HOOKDET
MICB2
MIC2P
MIC2N
XEARL
XEARLC
XEARR
XEARRC
RAPGSM
AUDIO_AMPS_EN(7:0)
L2000
220R/100MHz
2A
F2000
V2000
C2000
27p
C2001
1u0
R2000
220R
C2002
2u2
R2001
BGF100
C2003
33n
C2004
33n
to UEME
to Mic
J2002
L2001
EXC24CB102U
C2005
10n
C2006
10n
Charger plug
X2002
J2000
J2001
5V if USB connected
VBUS
2.5V if accessory connected
VOUT
600R/100MHz
Z2001
Z2000
System connector
X2000
charge
charge gnd
ACI
VOUT
Vbus
D+
D-
data gnd
Xmicn
Xmicp
Xear_l_n
Xear_l_p
Xear_r_n
Xear_r_p
AGND
C2011
C2012
C2013
C2014
10p
Analog switch/ Attenuator
N2000
TS5A3159DCKR
1.8V
VIO
C2020
100n
Cap for N2000 (pin 5)
J2003
R2002
22R
L2002
EXC24CB102U
J2004
R2004
22R
L2003
EXC24CB102U
Analog switch/ Attenuator
N2001
TS5A3159DCKR
1.8V
C2021
100n
Cap for N2001 (pin 5)
R2006
ESDA14V2-4BF2
C2007
C2008
C2009
C2010
10n
L2004
68nH
J2005
J2006
FMANT(1:0)
FM Radio
Z2003
600R/100MHz
IHF
B2102
L2104
220R/100MHz
L2108
56nH
L2109
J2103
J2104
RIGHT
C2111
C2112
22p
L2107
Audio amplifier
N2101
TPA2012D2YZH
C2119
C2120
C2118
C2117
100n
LEFT
VIHFAMP
VBAT
L2111
600R/100MHz
C2127
1u0
C2126
10U
C2124
100n
L2110
L2102
L2103
J2101
J2102
L2101
C2106
C2107
IHF
B2101
22
R2007
IP4065CX11_LF
17k
1k3
33R
15k
J2007
J2008
J2009
2.8V
VAUX
R2008
RESNET_220K_120K
SLAVEPU
DPRXD
DMTXD
MASTPD2
MASTPD1
ACI
USB_ACI(7:0)
RETU / TAHVO
R2030
100R
C2030
270p
GND

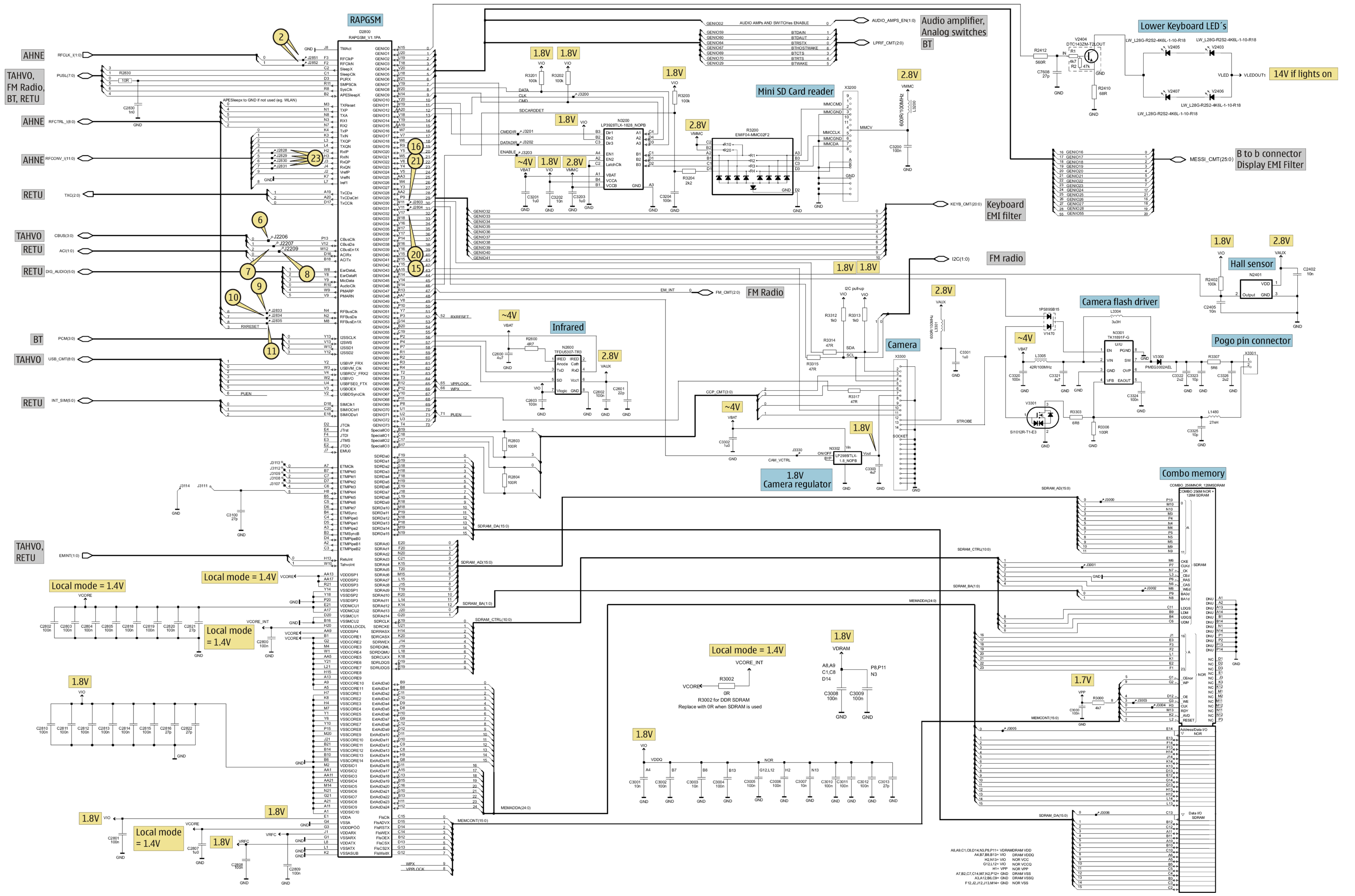
Retu


FM Radio
B to B connector
System connector
B to B connector
Microphone
B2100
R2100
EMIF01-SMIC01F2
C2100
33n
C2101
33n
MIC1P
MIC1N
MICB1
R2101
220R
C2102
2u2
AUDIO(8:0)
XAUDIO(7:0)
H_BRIDGE(3:0)
HFSPP
HFSPN
L2270
220R/100MHz
L2271
220R/100MHz
C2270
1n0
C2271
1n0
C2272
1n0
Vibra
M2100
4CR-1002W-07
VIBRAP
VIBRAN
L2272
220R/100MHz
L2273
220R/100MHz
C2273
1n0
C2274
1n0
C2275
1n0
Battery connector
X2070
J2070
J2071
J2072
J2073
VBAT
BSI
GND
BTEMP
R2071
14V/50V
R2070
47k
BTEMP Resistor
C2073
150u_10V
C2071
27p
C2072
27p
~4V
1.35V
VREF_INT
R2200
100k
2.8V
VANA
R2201
120k
R2213
4k7
R2214
4k7
VBACK
G2200
Backup battery
C2223
10n
C2224
10n
R2202
1k0
R2203
1k0
R2204
1k0
R2205
1k0
R2206
1k0
R2207
1k0
R2208
1k0
R2209
1k0
RETU
D2200
RETU_3.02
R2212
470R
C2200
1u0
4.7V if RF active
Depends on Sim 1.8V/3V
TAHVO,
AHNE
SLOWAD(6:0)
LS
LST
RFTEMP
VCHAR
WTXDET
C2202
1n0
C2203
1n0
C2204
1n0
C2205
1n0
C2206
1n0
C2207
1n0
Sleepclock oscillator
B2200
32.768kHz
C2208
27p
C2209
22p
R2216
2M2
C2281
1u0
WATCHDOG ENABLE
PWRONX
RAPGSM
DIG_AUDIO(5:0)
J2200
J2201
J2202
J2203
J2204
J2205
TAHVO
CBUS(3:0)
TAHVO
CHSWSTAT
J2210
J2212
RAPGSM
TXC(2:0)
RAPGSM
INT_SIM(5:0)
J2213
J2214
J2215
C2201
1u0
VRCP2
VRCP1
VSIM2
VSIM1
VRFC
VR1
VIO
VDRAM
VAUX
VANA
VREF_INT
VREF
1.8V
2.5V
1.8V
2.8V
1.35V
C2210
1u0
C2211
4u7
C2221
1u0
C2222
1u5
C2220
1u5
C2212
1u5
C2213
1u5
C2214
1u5
C2215
1u5
C2219
1u5
C2216
1u5
C2217
1u5
EMINT(1:0)
RAPGSM
USB_ACI(7:0)
TAHVO, System conn.
AFC
VCTCXO
TXC
AHNE
Depends on Sim 1.8V/3V
VSIM1
R2700
EMIF03-SIM02F2
SIM Reader Side
CLK
SIMDetX
X2701
SIM
C2700
100n
L2202
220R/100MHz
C2225
1u0
C2226
1u0
C2227
1u0
VBAT1
VBAT2
L2204
600R/100MHz
C2230
1u0
VBAT3
L2203
600R/100MHz
C2228
1u0
VBATCP
L2206
600R/100MHz
C2232
1u0
VBATH
L2205
220R/100MHz
C2231
10U
J2220
J2221
4V
PWRON
Power on key connector
R2408
4k7
C2408
27p
J3121
J2416
J2417
L2410
15nH
L2411
15nH
X7554
X7553
C2229
1n0
C2218
1n0
J2216
J2217
J2218
J2219
APE sleepX
PUSL(7:0)
TAHVO,
RAPGSM
RAPGSM
ACI(1:0)
GND
1
3
12
17
18
19

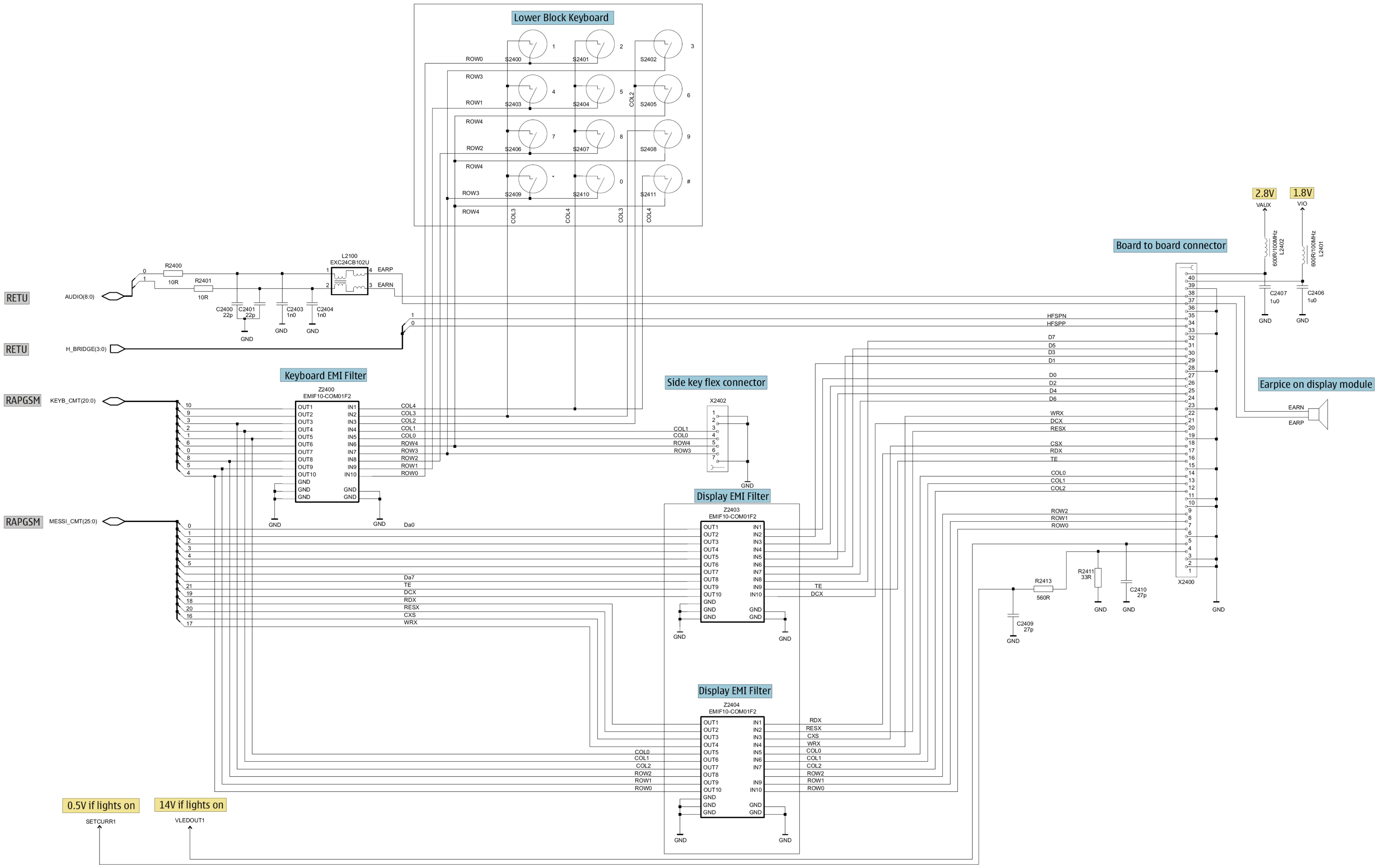
Tahvo


Local mode = 1.4V
VCORE
~4V
VBAT
C2309
22u
GND
C2302
22u
L2301
220R/100MHz
Flash interface
J2060
VBUS
VPP
GND
TXD
CLK
RXD
RXD2
X2060
Traceability pad
TAHVO
N2300
TAHVO_V5.2_LF
Charger plug
CHARGER
C2300
10n
C2301
22u
L2302
10uH
VBAT1
VCoreCoil
VCore
GND1
VCharIn1
VCharIn2
VCharInK
VCharOut1
VCharOut2
VCharOutK
VCharADC
ChSwS
SMPSClk
GND4
VBAT3
GND3
Slave_PU
Master_PD1
Master_PD2
CLK
RXD2
D+_RXD
D-_TXD
VPP_VIO
VCCint
VIO
OEX
FSE0
VO
RCV_FRX2
VP_FRX
VM_CLK
FTX
SLAVESWSET
RSTX
PURX
SLEEPX
TahvoInt
CbusData
CbusSelX
CbusClk
VcoreDef
FlashM
TestMode
TestOut
GenOut1
GenOut2
GenOut3
PWM300
Clk600
SleepClk
NC
GND5
Vout
SENSE+
SENSE-
VCC
C2303
1u0
1.8V
VIO
C2304
10n
USB_ACI(7:0)
RETU, System connector
~4V
VBAT
R2307
100R
RSX101VA-30TR
V2302
C2306
1u0
J2300
USB_CMT(8:0)
RAPGSM
PUSL(7:0)
RAPGSM
EMINT(1:0)
RAPGSM
CBUS(3:0)
RETU
RETU
SLOWAD(6:0)
RETU
CHSWSTAT
~4V
VBAT
L2306
600R/100MHz
C2307
1u0
J2309
J2314
J2310
J2311
J2312
J2313
J2315
J2317
J2316
1.8V if lights on
2.5V if accessory connected
VOUT
C2312
1u0
SENSE+
SENSE-
5V if USB connected
VBUS
C2313
1u0
CURRENT_SEN_30um
R2300
BGND
Current gauge
J2308
13
~4V
VBAT
L2305
600R/100MHz
C2305
1u0
Power supply for display and keyboard lights
14V if lights on
VLEDOUT1
L2304
22uH
LED Driver
N2301
4W_LED_DRIVER
PWMTAHVO
SETCURR1
EN
IND
FB
NC
VOUT
VDD
AGND
PGND
C2314
4u7
C2315
4u7
C7607
56p
C7609
27p
GND

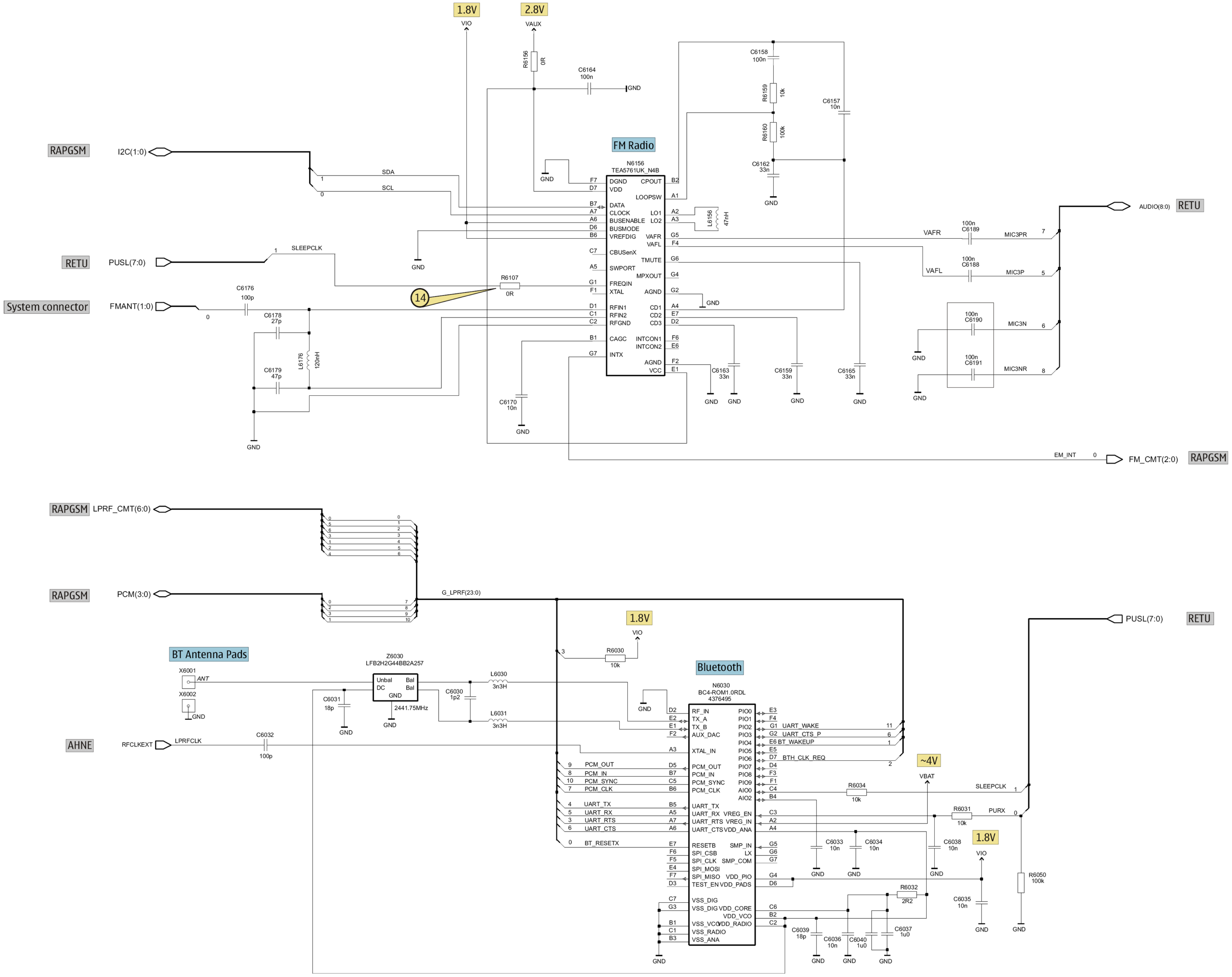
RAPGSM, Combo memory, Camera


RAPGSM
D2800
RAPGSM_V1.1PA
AHNE
RFCLK_I(1:0)
TAHVO,
FM Radio,
BT, RETU
PUSL(7:0)
AHNE
RFCTRL_I(8:0)
AHNE
RFCONV_I(11:0)
RETU
TXC(2:0)
TAHVO
CBUS(3:0)
RETU
ACI(1:0)
RETU
DIG_AUDIO(5:0)
BT
PCM(3:0)
TAHVO
USB_CMT(8:0)
RETU
INT_SIM(5:0)
TAHVO,
RETU
EMINT(1:0)
Local mode = 1.4V
Local mode = 1.4V
Local mode
= 1.4V
Local mode
= 1.4V
1.8V
1.8V
1.8V
1.8V
Audio amplifier,
Analog switches
BT
AUDIO_AMPS_EN(1:0)
LPRF_CMT(2:0)
Mini SD Card reader
1.8V
1.8V
1.8V
1.8V
2.8V
2.8V
~4V
1.8V
2.8V
Lower Keyboard LED´s
14V if lights on
B to b connector
Display EMI Filter
MESSI_CMT(25:0)
Keyboard
EMI filter
KEYB_CMT(20:0)
FM radio
I2C(1:0)
FM Radio
FM_CMT(2:0)
1.8V
1.8V
2.8V
Camera
Infrared
~4V
2.8V
~4V
1.8V
1.8V
Camera regulator
1.8V
2.8V
Hall sensor
Camera flash driver
~4V
Pogo pin connector
Combo memory
COMBO_256MNOR_128MSDRAM
1.8V
VDRAM
Local mode = 1.4V
VCORE_INT
R3002 for DDR SDRAM
Replace with 0R when SDRAM is used
1.7V
1.8V
2
6
7
8
9
10
11
23
16
21
20
15

UI

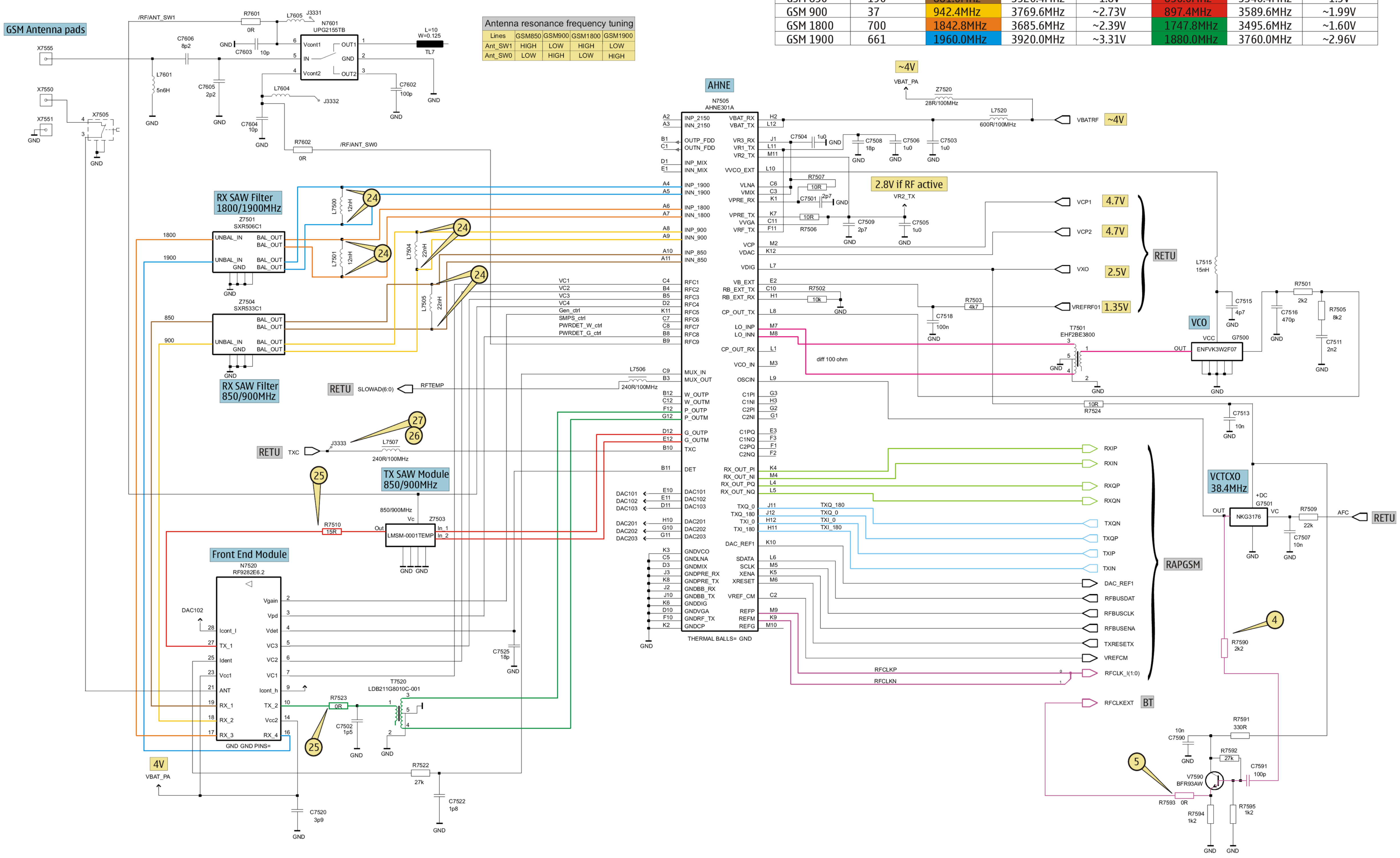

Lower Block Keyboard
S2400
S2401
S2402
S2403
S2404
S2405
S2406
S2407
S2408
S2409
S2410
S2411
ROW0
ROW1
ROW2
ROW3
ROW4
COL2
COL3
COL4
1
2
3
4
5
6
7
8
9
*
0
#
RETU
AUDIO(8:0)
R2400
10R
R2401
10R
C2400
22p
C2401
22p
C2403
1n0
C2404
1n0
L2100
EXC24CB102U
EARP
EARN
GND
RETU
H_BRIDGE(3:0)
Keyboard EMI Filter
Z2400
EMIF10-COM01F2
RAPGSM
KEYB_CMT(20:0)
OUT1
OUT2
OUT3
OUT4
OUT5
OUT6
OUT7
OUT8
OUT9
OUT10
IN1
IN2
IN3
IN4
IN5
IN6
IN7
IN8
IN9
IN10
COL0
COL1
RAPGSM
MESSI_CMT(25:0)
Da0
Da7
TE
DCX
RDX
RESX
CXS
WRX
Side key flex connector
X2402
Display EMI Filter
Z2403
EMIF10-COM01F2
Display EMI Filter
Z2404
EMIF10-COM01F2
Board to board connector
X2400
HFSPN
HFSPP
D7
D5
D3
D1
D0
D2
D4
D6
CSX
2.8V
VAUX
1.8V
VIO
600R/100MHz
L2402
600R/100MHz
L2401
C2407
1u0
C2406
1u0
Earpice on display module
R2413
560R
R2411
33R
C2409
27p
C2410
27p
0.5V if lights on
SETCURR1
14V if lights on
VLEDOUT1

BT, FM Radio


1.8V
VIO
2.8V
VAUX
R6156
0R
C6164
100n
GND
FM Radio
N6156
TEA5761UK_N4B
DGND
VDD
DATA
CLOCK
BUSENABLE
BUSMODE
VREFDIG
CBUSenX
SWPORT
FREQIN
XTAL
RFIN1
RFIN2
RFGND
CAGC
INTX
CPOUT
LOOPSW
LO1
LO2
VAFR
VAFL
TMUTE
MPXOUT
AGND
CD1
CD2
CD3
INTCON1
INTCON2
VCC
L6156
47nH
C6158
100n
R6159
10k
R6160
100k
C6162
33n
C6157
10n
C6163
33n
C6159
33n
C6165
33n
C6170
10n
RAPGSM
I2C(1:0)
SDA
SCL
RETU
PUSL(7:0)
SLEEPCLK
R6107
0R
14
System connector
FMANT(1:0)
C6176
100p
C6178
27p
L6176
120nH
C6179
47p
AUDIO(8:0)
VAFR
VAFL
100n
C6189
MIC3PR
100n
C6188
MIC3P
100n
C6190
MIC3N
100n
C6191
MIC3NR
EM_INT
FM_CMT(2:0)
LPRF_CMT(6:0)
PCM(3:0)
G_LPRF(23:0)
BT Antenna Pads
X6001
ANT
X6002
Z6030
LFB2H2G44BB2A257
Unbal
DC
Bal
Bal
2441.75MHz
C6031
18p
C6030
1p2
L6030
3n3H
L6031
3n3H
AHNE
RFCLKEXT
LPRFCLK
C6032
100p
R6030
10k
Bluetooth
N6030
BC4-ROM1.0RDL
4376495
RF_IN
TX_A
TX_B
AUX_DAC
XTAL_IN
PCM_OUT
PCM_IN
PCM_SYNC
PCM_CLK
UART_TX
UART_RX
UART_RTS
UART_CTS
RESETB
SPI_CSB
SPI_CLK
SPI_MOSI
SPI_MISO
TEST_EN
VSS_DIG
VSS_DIG
VSS_VCO
VSS_RADIO
VSS_ANA
PIO0
PIO1
PIO2
PIO3
PIO4
PIO5
PIO6
PIO7
PIO8
PIO9
AIO0
AIO2
VREG_EN
VREG_IN
VDD_ANA
SMP_IN
LX
SMP_COM
VDD_PIO
VDD_PADS
VDD_CORE
VDD_VCO
VDD_RADIO
BT_RESETX
UART_WAKE
UART_CTS_P
BT_WAKEUP
BTH_CLK_REQ
~4V
VBAT
R6034
10k
SLEEPCLK
R6031
10k
PURX
R6050
100k
C6033
10n
C6034
10n
C6038
10n
C6035
10n
R6032
2R2
C6039
18p
C6036
10n
C6040
1u0
C6037
1u0

RF part

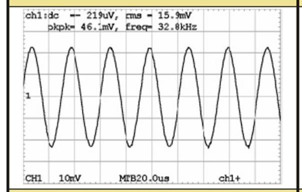
Band	Chennel	RX	VCO/RX	VC/RX	TX	VCO/TX	VC/TX
GSM 850	190	881.6MHz	3526.4MHz	~1.8V	836.6MHz	3346.4MHz	~1.5V
GSM 900	37	942.4MHz	3769.6MHz	~2.73V	897.4MHz	3589.6MHz	~1.99V
GSM 1800	700	1842.8MHz	3685.6MHz	~2.39V	1747.8MHz	3495.6MHz	~1.60V
GSM 1900	661	1960.0MHz	3920.0MHz	~3.31V	1880.0MHz	3760.0MHz	~2.96V


GSM Antenna pads
X7555
X7550
X7551
X7505
/RF/ANT_SW1
R7601 0R
L7605
J3331
N7601 UPG2155TB
Vcont1
OUT1
IN
GND
Vcont2
OUT2
L=10 W=0.125
TL7
C7606 8p2
C7603 10p
L7601 5n6H
C7605 2p2
L7604
J3332
C7604 10p
C7602 100p
R7602 0R
/RF/ANT_SW0
GND
RX SAW Filter 1800/1900MHz
Z7501 SXR506C1
UNBAL_IN
BAL_OUT
1800
1900
L7500 12nH
L7501 12nH
L7504 22nH
L7505 22nH
Z7504 SXR533C1
850
900
RX SAW Filter 850/900MHz
AHNE
N7505 AHNE301A
INP_2150
INN_2150
OUTP_FDD
OUTN_FDD
INP_MIX
INN_MIX
INP_1900
INN_1900
INP_1800
INN_1800
INP_900
INN_900
INP_850
INN_850
RFC1
RFC2
RFC3
RFC4
RFC5
RFC6
RFC7
RFC8
RFC9
VC1
VC2
VC3
VC4
Gen_ctrl
SMPS_ctrl
PWRDET_W_ctrl
PWRDET_G_ctrl
MUX_IN
MUX_OUT
W_OUTP
W_OUTM
P_OUTP
P_OUTM
G_OUTP
G_OUTM
TXC
DET
DAC101
DAC102
DAC103
DAC201
DAC202
DAC203
GNDVCO
GNDLNA
GNDMIX
GNDPRE_RX
GNDPRE_TX
GNDBB_RX
GNDBB_TX
GNDDIG
GNDVGA
GNDRF_TX
GNDCP
THERMAL BALLS= GND
VBAT_RX
VBAT_TX
VR3_RX
VR1_TX
VR2_TX
VVCO_EXT
VLNA
VMIX
VPRE_RX
VPRE_TX
VVGA
VRF_TX
VCP
VDAC
VDIG
VB_EXT
RB_EXT_TX
RB_EXT_RX
CP_OUT_TX
LO_INP
LO_INN
CP_OUT_RX
VCO_IN
OSCIN
C1PI
C1NI
C2PI
C2NI
C1PQ
C1NQ
C2PQ
C2NQ
RX_OUT_PI
RX_OUT_NI
RX_OUT_PQ
RX_OUT_NQ
TXQ_0
TXQ_180
TXI_0
TXI_180
DAC_REF1
SDATA
SCLK
XENA
XRESET
VREF_CM
REFP
REFM
REFG
~4V
VBAT_PA
Z7520 28R/100MHz
L7520 600R/100MHz
VBATRF
C7504 1u0
C7508 18p
C7506 1u0
C7503 1u0
2.8V if RF active
VR2_TX
R7507 10R
C7501 2p7
R7506 10R
C7509 2p7
C7505 1u0
VCP1 4.7V
VCP2 4.7V
VXO 2.5V
VREFRF01 1.35V
RETU
L7515 15nH
R7502 10k
R7503 4k7
C7518 100n
T7501 EHF2BE3800
diff 100 ohm
C7515 4p7
C7516 470p
R7501 2k2
R7505 8k2
C7511 2n2
VCO
G7500 ENFVK3W2F07
OUT
VCC
R7524 10R
C7513 10n
RXIP
RXIN
RXQP
RXQN
TXQN
TXQP
TXIP
TXIN
DAC_REF1
RFBUSDAT
RFBUSCLK
RFBUSENA
TXRESETX
VREFCM
RFCLK_I(1:0)
RFCLKP
RFCLKN
RAPGSM
RFCLKEXT
BT
VCTCXO 38.4MHz
G7501 NKG3176
+DC
VC
R7509 22k
C7507 10n
AFC
RETU
R7590 2k2
R7591 330R
C7590 10n
R7592 27k
C7591 100p
V7590 BFR93AW
R7593 0R
R7594 1k2
R7595 1k2
L7506 240R/100MHz
RETU
SLOWAD(6:0)
RFTEMP
RETU
TXC
J3333
L7507 240R/100MHz
TX SAW Module 850/900MHz
850/900MHz
Z7503 LMSM-0001TEMP
Vc
Out
In_1
In_2
R7510 15R
Front End Module
N7520 RF9282E6.2
DAC102
Vgain
Vpd
Icont_I
Vdet
TX_1
VC3
Ident
VC2
Vcc1
VC1
ANT
Icont_h
RX_1
TX_2
RX_2
Vcc2
RX_3
RX_4
GND GND PINS=
C7525 18p
T7520 LDB211G8010C-001
R7523 0R
C7502 1p5
4V
VBAT_PA
R7522 27k
C7520 3p9
C7522 1p8
24
25
26
27
4
5

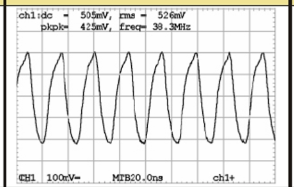
Antenna resonance frequency tuning				
Lines	GSM850	GSM900	GSM1800	GSM1900
Ant_SW1	HIGH	LOW	HIGH	LOW
Ant_SW0	LOW	HIGH	LOW	HIGH

Signal overview

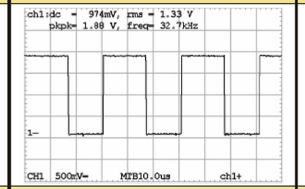
1) 32 kHz at C2228



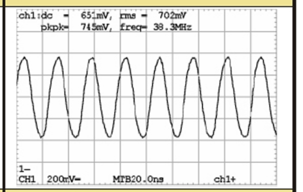
2) RFCLK at J2851-J2852



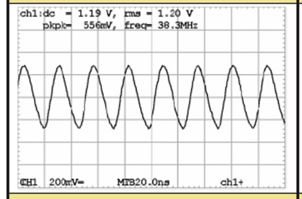
3) SleepCLK at J2217



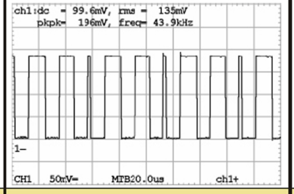
4) VCTCXO 38.4 Mhz at R7590



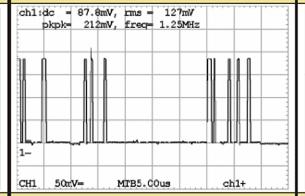
5) RFCLKEXT at R7593



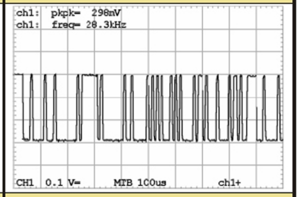
6) CBUSCLK at J2206



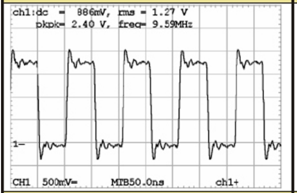
7) CBUSDA at J2207



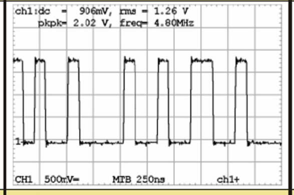
8) CBUSENX at J2209



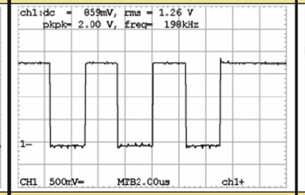
9) RFBUSCLK at J2833



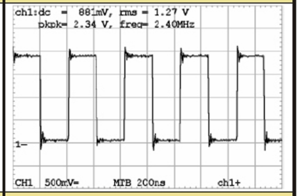
10) RFBUSDA at J2834



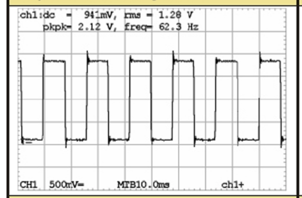
11) RFBUSENX at J2835



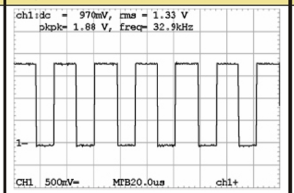
12) AUDIOCLK at J2200



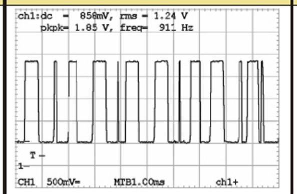
13) SMPSCLK at J2308



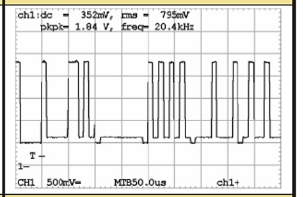
14) FMSLEEPCLK at R6107



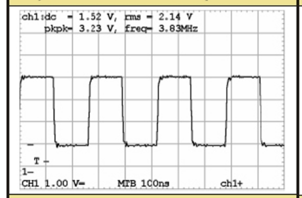
15) FMSCL at J2804



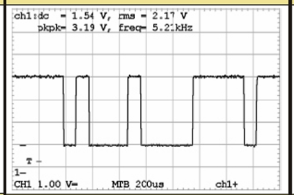
16) FMSDA at J2803



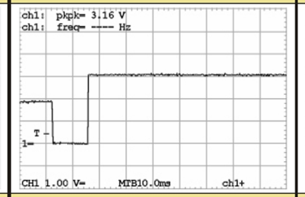
17) SIMCLK at X 2701 pin 1



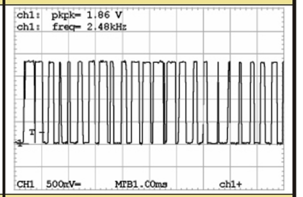
18) SIMDA at X2701 pin 5



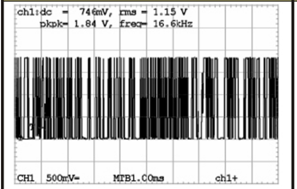
19) VSIM at X2701 pin 3



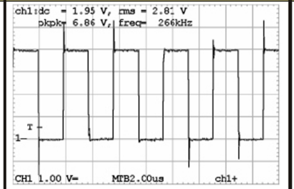
20) CAMERASCL at J2804



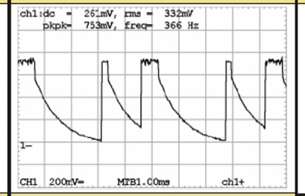
21) CAMERASDA at X2803



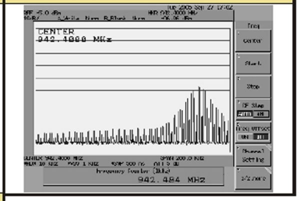
22) IHF speaker at J2101-J2104



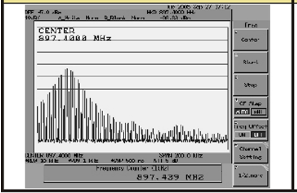
23) RXIQ GSM900 at J2828-J2831



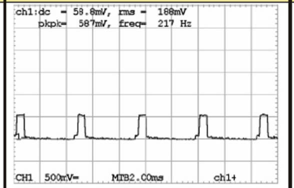
24) RX at L7500,L7501,L7504,L7505



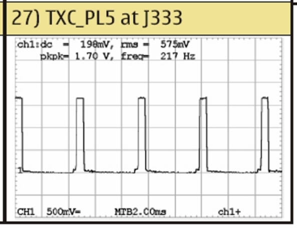
25) TX at R7510, R7523

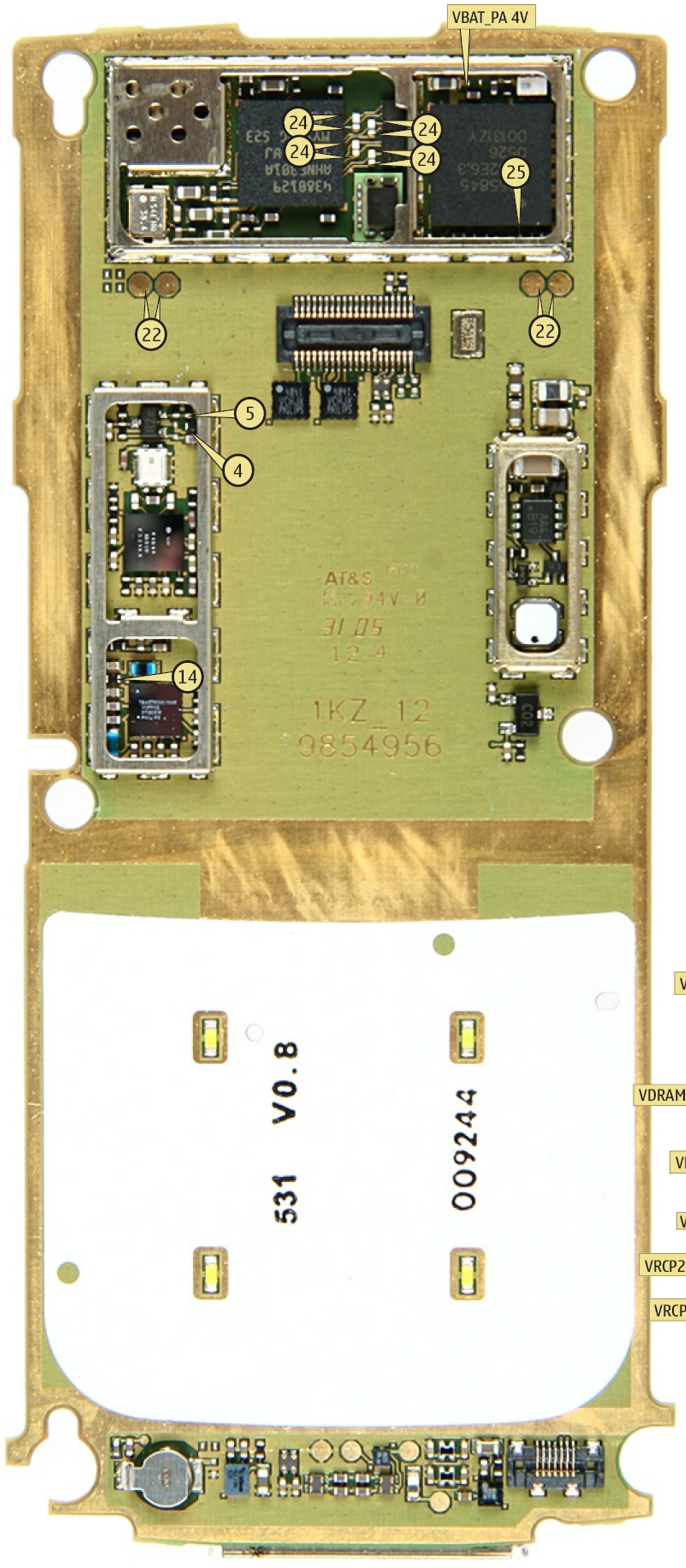


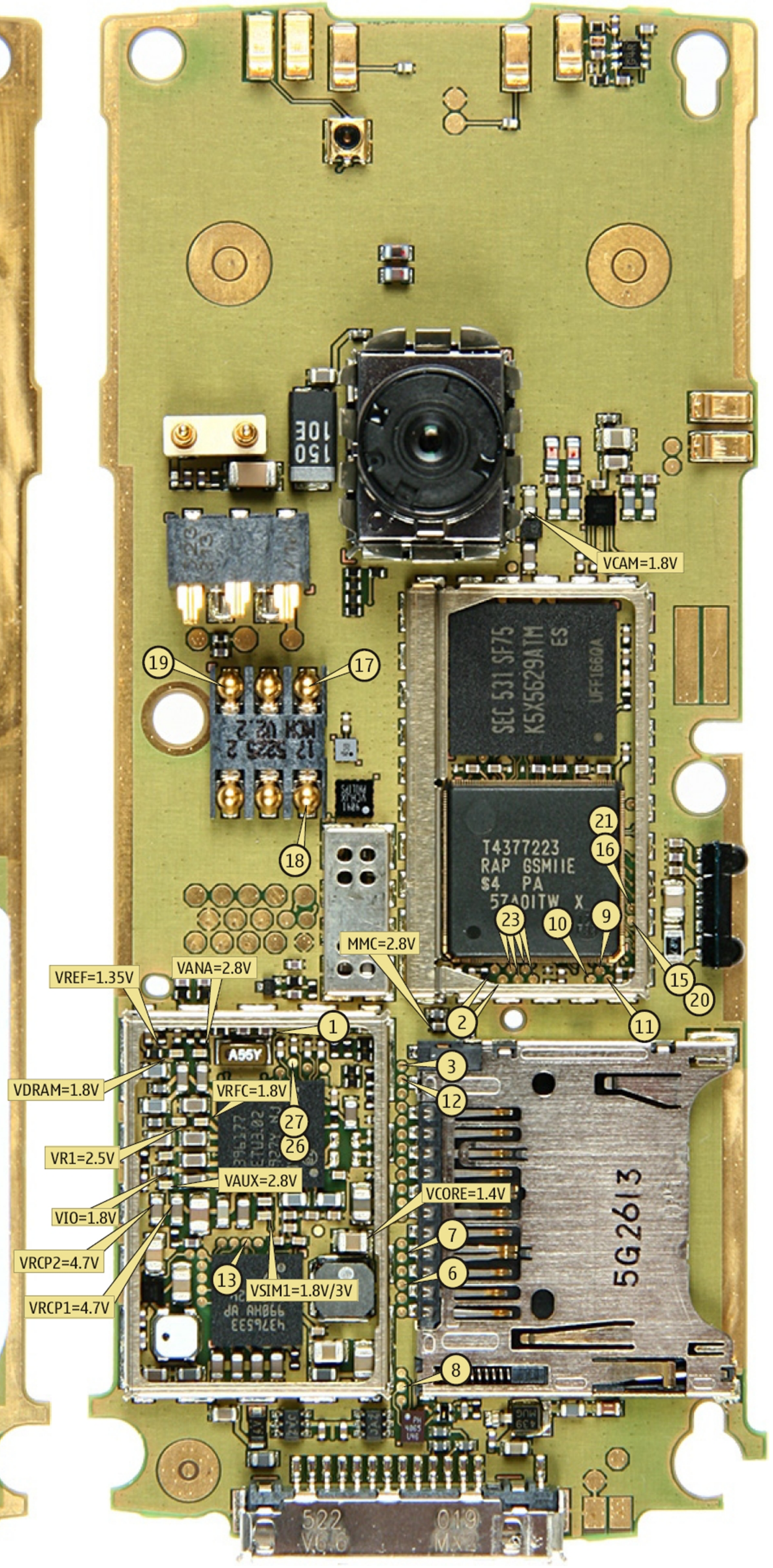
26) TXC_PL19 at J333



27) TXC_PL5 at J333






VCAM=1.8V
19
17
18
21
16
23
10
9
15
20
VREF=1.35V
VANA=2.8V
MMC=2.8V
1
2
11
VDRAM=1.8V
VRFC=1.8V
3
12
27
26
VR1=2.5V
VAUX=2.8V
VCORE=1.4V
VIO=1.8V
7
VRCP2=4.7V
13
VSIM1=1.8V/3V
6
VRCP1=4.7V
8
5G2613

Component finder

B	
B2200	N7
C	
C2000	S4
C2001	T4
C2002	T4
C2003	T4
C2004	T4
C2005	T4
C2006	T4
C2007	T7
C2008	T6
C2009	T6
C2010	T7
C2011	T5
C2012	T5
C2013	T5
C2014	T5
C2020	S6
C2021	S6
C2030	S5
C2071	I8
C2072	T2
C2073	F7
C2100	T7
C2101	T7
C2102	S7
C2106	G3
C2107	G3
C2111	G2
C2112	G2
C2117	H3
C2118	H3
C2119	H2
C2120	H3
C2124	G3
C2126	F3
C2127	G3
C2200	O6
C2201	O8
C2202	N9
C2203	N7
C2204	N7
C2205	N6
C2206	N7
C2207	N8
C2208	N7
C2209	N7
C2210	P8
C2211	Q8
C2212	Q7
C2213	O8
C2214	O8
C2215	P8
C2216	P8
C2217	N8
C2218	Q7
C2219	N8
C2220	P7
C2221	P9
C2222	P8
C2223	P6
C2224	O6
C2225	O8
C2226	P8
C2227	P7
C2228	P8
C2229	Q7
C2230	O8
C2231	P6
C2232	P8
C2273	Q7
C2274	Q7
C2275	Q6
C2281	P9
C2300	R6
C2301	R6
C2302	Q6
C2303	S8
C2304	Q7
C2305	S9
C2306	S8
C2307	S7
C2309	R6
C2312	S7
C2313	S8
C2314	Q8
C2315	Q9
C2400	M8
C2401	M8
C2402	I7
C2403	F6
C2404	F5
C2405	J7
C2406	F7
C2407	E7
C2408	P9
C2409	Q8
C2410	D6
C2600	L2
C2601	L2
C2602	L2
C2603	L2
C2700	J6
C2800	L5
C2801	M5
C2802	L5
C2803	K5
C2804	M5
C2805	J2
C2807	M5
C2808	M5
C2809	M5
C2810	K5
C2811	K3
C2812	L5
C2813	M2
C2814	M5
C2815	K5
C2818	K3
C2819	K4
C2820	M3
C2830	M4
C3000	I2
C3001	I2
C3002	I2
C3003	J5
C3004	J5
C3005	I5
C3006	I5
C3007	I5
C3008	J5
C3009	I5
C3010	M2
C3011	K4
C3012	K3
C3013	K4
C3100	M7
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C3201	L6
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C3320	F8
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C6039	G3
C6040	H2
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C6158	I3
C6159	J3
C6162	I2
C6163	I2
C6164	J3
C6165	J3
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C6176	J2
C6178	J2
C6179	J2
C6188	J2
C6189	J3
C6190	N6
C6191	N6
C7501	A4
C7502	A7
C7503	C3
C7504	A4
C7505	C3
C7506	C3
C7507	C3
C7508	C3
C7509	C3
C7511	B3
C7513	C3
C7515	A3
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C7606	A3
C7607	R9
C7608	N7
C7609	R9
D	
D2200	O7
D2800	L4
D3000	I4
F	
F2000	S3
G	
G2200	T3
G7500	B3
G7501	C2
J	
J2000	T2
J2001	T3
J2002	O5
J2007	S5
J2008	S5
J2009	S5
J2003	T5
J2004	T6
J2005	T6
J2006	T5
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J2072	I7
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J2101	D2
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J2200	O5
J2201	P5
J2202	P5
J2203	P5
J2204	O6
J2205	O7
J2206	Q5
J2207	Q5
J2209	Q5
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J2311	Q8
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J2835	M3
J2851	M4
J2852	M4
J3000	H4
J3001	H4
J3002	K2
J3003	H3
J3004	J5
J3005	J5
J3006	J4
J3107	L8
J3108	L7
J3109	L7
J3111	M7
J3112	L7
J3113	L8
J3114	M7
J3121	M7
J3200	L6
J3201	L6
J3202	L6
J3203	L6
J3330	H4
J3331	F2
J3332	G2
J3333	O7
L	
L1480	G8
L2000	S3
L2001	T4
L2002	T5
L2003	T6
L2004	T6
L2100	E6
L2101	G3
L2102	F3
L2103	F3
L2104	G2
L2107	G2
L2108	D5
L2109	D5
L2110	G3
L2111	F3
L2202	O9
L2203	O9
L2204	O9
L2205	O9
L2206	P8
L2272	P7
L2273	P6
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L2302	Q6
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L2306	T7
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L3301	E6
L3304	I8
L3305	E8
L6030	G3
L6031	G2
L6156	I2
L6176	J2
L7500	B5
L7501	B5
L7502	C4
L7504	B5
L7505	B5
L7506	A5
L7507	C5
L7515	B3
L7601	A3
N	
N2000	S7
N2001	S6
N2101	G3
N2300	R7
N2301	R9
N2401	J7
N2600	L1
N3200	L6
N3301	G8
N3302	G4
N6030	G3
N6156	J3
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N7520	B7
N7601	A2
R	
R2000	T4
R2001	T4
R2002	T6
R2004	T6
R2006	T6
R2007	S5
R2008	S5
R2030	S4
R2070	T2
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R2100	T7
R2101	T7
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R2408	P9
R2410	M7
R2411	D6
R2412	N7
R2413	Q8
R2600	M2
R2700	J6
R2803	K5
R2804	K5
R2830	M4
R3000	J2
R3002	L5
R3200	M6
R3201	L6
R3202	L6
R3203	M6
R3204	M6
R3303	H7
R3306	G7
R3307	G8
R3312	H6
R3313	I6
R3314	H6
R3315	H6
R3317	H6
R6030	H3
R6031	G2
R6032	H2
R6034	G3
R6050	G2
R6107	I2
R6156	I3
R6159	I2
R6160	I2
R7501	B3
R7502	A4
R7503	C4
R7505	B3
R7506	C4
R7507	A4
R7509	C3
R7510	C7
R7522	C7
R7523	A7
R7524	C4
R7590	F3
R7591	F2
R7592	F2
R7593	F3
R7594	F3
R7601	B3
R7602	A3
T	
T7501	B2
T7520	A8
V	
V1470	H8
V2000	S4
V2302	S7
V2403	Q7
V2404	N7
V2405	N7
V2406	Q3
V2407	N3
V3300	G8
V3301	H7
V7590	F2
X	
X2000	T5
X2060	E7
X2070	H7
X2400	E5
X2402	T8
X2701	J7
X3200	Q3
X3300	F5
X3301	F8
X6001	F1
X6002	F1
X7505	B6
X7550	A7
X7551	A7
X7553	A6
X7554	A4
X7555	A3
Z	
Z2000	T5
Z2001	T5
Z2003	S5
Z2400	K6
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Z2404	F4
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Z7501	B6
Z7503	C6
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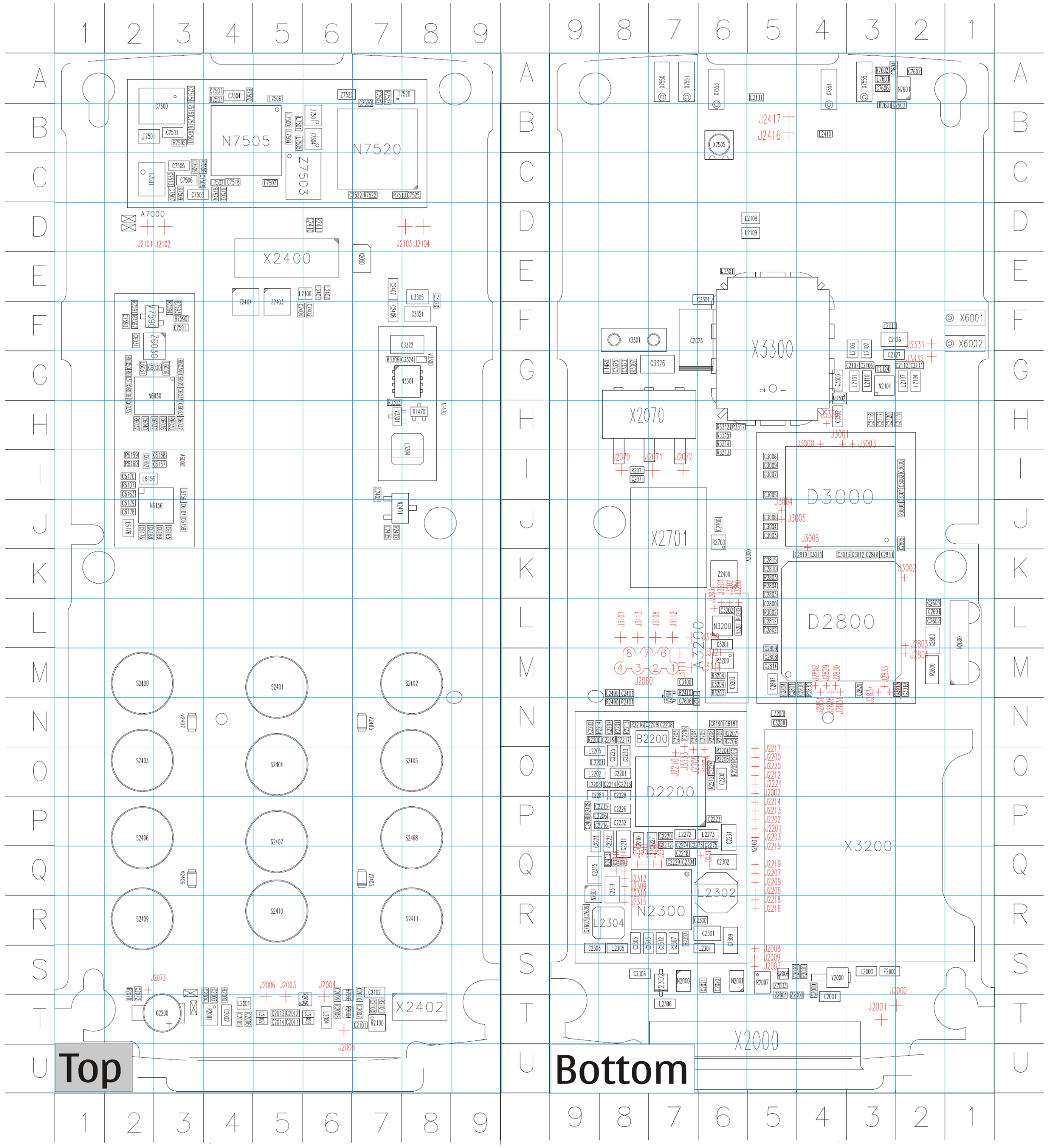
Z7520	A6



Glossary

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A/D-converter	Analog-to-digital converter
ACI	Accessory Control Interface
ADC	Analog-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic ,type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2,UEME and Zocus
CCP	Compact Camera Port
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSR	cambridge silicon radio
CSTN	Color Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analouge converter
DAC	Digital-to-analouge converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo
DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package

DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evaluation
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compability
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared
IrDA	Infrared Data Associasion
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode

LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architechture
OMAP	Operations, maintenance, and administartion part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency
RF PopPort TM	Reduced function PopPortTM interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multi Media Card
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver

SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noice ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP, Official Tiku3G
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WD	Watchdog
XHTML	Extensible hypertext markup language
Zocus	Current sensor, (used to monitor the current flow to and from the battery)